Notes of

Lectures

upon

Chemistry

By

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taken by

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Of the Nitrous Acid.

Nitrous Acid is only found in Common Nitre, and Nitrous Ammoniac, and it is extremely probable that it is never found in a Separate State, but in Consequence of the putrefaction of Animal & Vegita- ble Substances only. The common Matrix of it is the upper Stratum or Soil of the Ground, as far down as the Roots of Vegitables reach. But as the Acid of Nitre is obtained from Subjects always in Com- bination w: Alkali we shall forbear saying any more concerning its Productio- n till we treat of Neutral Salts. J

shall therefore confine myself at present to the means by which we may extricate it from Bodies in which it is present, & its different Properties when extricated.

It may be extracted from Nitre by Distillation w^th the Addition of pure Clay or brick Dust &c. as we said before "by dividing the Aggregate present Union, and favour the Resolution" — The Reason assigned for the good Effects of Clay in the preceding Proposition is the true One, nor does it act as some Chemists have supposed by the Vitriolic Acid present, since M^r Pott found y^t the Distillation succeeded as well w^th a Bole perfectly freed from any

saline matter: but y^e troublesome Appa-
-ratus, and great Heat required has oc-
-casioned this practice to be generally deserted,
and the more commodious one of the
addition of Vitriolic Acid Alone, or com-
-bined w^th Iron in the form of green vitriol,
to be substituted in its Room. by this
Means the Oil is disjoined by Oil from y^e
first Alkali, and must be immediately
dissipated before it can be combined w^th
the Iron or Earth if vitriol or Alum aremed.
I acquiesce all the necessary Directions
for this Process. I shall only remark the
erroneous Opinion of some, who direct y^e
Water should be added in the Distillation to

prevent the escape of fumes, for y^e fumes of water are more elastic than those of the acid. This Practice is only fit for large Works. The Distillation is performed w^th less Heat, and more Convenience to the private Chemist when vitriol. Acid is used alone. The Nitre must first be reduced to powder. Some have advised this to be done by means of Calcination, that the Water contained in the Crystals of the Nitre may be dissipated, but y^e fumes of such calcined Acid are very difficult to manage. To this powder must be added vitriolic Acid, tho' y^e proper proportion remains still a Dispute. The general Rule is to add one part of vitriolic Acid to

two parts of Nitre. Dr. Lewis observes y: in this proportion the Residuum is a mass not soluble in water, and therefore difficulty cleansed from the Retort. The London College directs three parts of Nitre to one of Ox, by this means we not only get y^e^ Nitrous Acid, but a Residuum which is a Nitre: Tartar. But if we are not anxious to preserve the Residuum I think the former proportion may be employed as it more entirely calcinates the Nitrous Acid. When we have prepared the Nitre it must be put into a Retort, and the Lutings ought to be suffered to be quite dry before we apply the Fire. The Heat must be very gradually

encreased 'till the whole is in Fusion, & must be continued 'till Fumes cease to rise. After the Process is finished we must suffer the Vessels to cool, before we open them, because they are filled w: uncon- -densed Fumes for a long time after the Operation is over, w: would escape if they were not accurately closed; the sudden Ad- -mission of Air also frequently breaks the distilling Vessels. The Nitrous Acid thus Obtained is usually mixed w: some Oz w: rises in Distillation, and w: a portion of the muriatic Acid proceding from y common Salt always present in Nitre, and decomposed also by the Vitriolic Acid. It

may be separated from the vitriolic by Co=
-hobation, and from y^{e} Muriatic by a
Solution of Silver in Nitrous Acid to which
the former has the greatest Affinity. It is
a Law that when Nitrous Acid is in hugna=
-ted wth Vitriolic and Muriatic Acid, they may
be precipitated in form of White Clouds
by the addition of a Solution of Silver. thus
the Trouble of two Operations is prevented.

This Acid when concentrated sends out
reddish Fumes, and is of a light Orange
Colour. the Colour however varies accord^{g}:
to the different matters wth w^{h} it is combined
in an impure State. thus Distillations of
green Vitriol produces an Acid differing
from the ~~green~~ orange Colour, and w^{h} White

Vitriol a corrosive Liquor. Mr Ruelle
after 5 Days labour obtained a nitrous
Acid whose Specific gravity was to that
Water as 15 to 10. but when its Specific
gravity is as 14 to 10 it is sufficiently
concentrated for any purposes I am
acquainted with. in this State we ought
to preserve it for use, since it is more
easy to dilute a concentrated Acid for
purposes w^ch require it, as the Solution
of Silver than to concentrate a dilute
Acid for the purposes w^ch require it in
that State. Such is the Inflamation
of Oils. this Acid when very dilute is of
a green Colour, w^ch may be entirely dis-
=charged by the addition of pure Silver.

If the green Colour or any other take place
after the Addition of the Silver. we may
be certain that the Silver contains Copper
or some foreign matters adhering to it.
If Nitrous Acid is much diluted, & subjected
to Distillation, the Result will be an Acid
giving no Fumes.

Let us now consider its Relation
to other Bodies beginning w: th e/ Saline.
It unites w: th the Saline producing
Effervescence & Heat. its union w: th the
Alkalies is attended w: th 2d e/ same Phæno-
-na as the Vitriolic. its power of Satura-
-tion and Attraction is considerably less,
and the Neutrals produced entirely different.
one Z: of first Alkali saturates 7/4 of Nitrous

Acid, whereas the same Quantity satu-
-rates only ℥v of Vitriolic.

It unites ℔ss: all Inflammables. gen-
-erating Heat and Effervescence, except ℔ss:
Sulphur with which it seems to refuse
all union. in the 16th Century it was
found ℈: a sudden Mixture of Oil &
Essential Oils produced actual Flame.
The Experiment was long neglected 'till
Dr. Hoffman revived it, and found ℈ all
the distilled and most of the expressed Oils
might be inflamed by the Assistance of
Nitrous Vitriolic Acid. from later Experiments
we are informed that all ℈ Oils un-
-der a certain Management might

be inflamed by the Nitrous Acid alone.

It unites w: Alcohol producing a Species of Ether.

It unites w: all Metallic Bodies except Gold, and perhaps Platina. Tin & Antimony it only corrodes, but suspends the Others in a fluid Form.

It unites w: Absorbent Earths of every kind.

It unites w: water producing Heat, but w: Ice it produces Excessive Cold. we may produce a greater Artificial Cold by this kind than any Other Body.

It attracts Moisture from the Air. we are ignorant of its further Effects upon this Fluid.

It has the same Effects on the Vitriolic

bird upon Animal and Vegitable Substances only in a less Degree.

When combined w: Alkalies or Metals it deflagrates in Contact w: y 4th & Fire.

Of the Muriatic Acid.

It is a Native Substance, & whether it may not be produced by Art is much to be doubted. It is always found either combined into Common Salt, or common Ammoniac. In the first of these every Person will acknowledge it to be a Natural Substance, but as the common Ammoniac is never found except in Consequence of Inflammation, it has

been reckoned by some, & perhaps not unjustly an artificial substance.

This Acid is chiefly distilled from Common Salt as it is cheaper than Ammoniacus not that there is any Difference in the Acid Obtained from either Subject. the Distillation must be performed by the addition of pure Vitriolic Acid, or some of its Concretes with Earths. we cannot employ crude Vitriol as in the Case of Nitre, because the Iron becoming volatile from a particular power which the Muriatic Acid exerts towards Some Metals, will rise into the Receiver, and intermix with the product. it is as yet disputed that this Acid renders Calcarious Earths volatile. I think Bergman that the

Vitriolic Acid should always be employed
in its seperate State. a portion of the
Acid will inevitably rise in the Distillation,
but we may extricate it perfectly by the
addition of Calcarious Earth w.ch & Vitriolic
Acid only corrodes, and will therefore
subside w.th it in the form of powder. we
must use very firm and accurate Lutings
giving them time to dry before the Ope-
-ration, since the Fumes of this Acid
are scarcely to be confined by any ma-
-nagument except by a large Addition
of Water, which we cannot employ when
we require a very concentrated Acid. we
may determine when the Distillation is

sufficiently advanced by ye Appearance of deep yellow Fumes, and Air Bubbles on the Surface. its Specific Gravity however is a more invariable Rule, which in its purest State is to ye: of Water as 12 to 10. In this State it is of a Gold Colour emitting copious Fumes w: Subside when it is very much diluted w: water. we shall next mention its affinity to ye Other Classes of Bodies.

It unites w: all Saline Bodies w: the same Phanomena as the Nitrous and Vitriolic, and produces w: Alkali diffr: Neutrals. from this it may be expelled by either of the former Acids. Zi of fixt Alkali saturates Zxxi of this Acid.

It does not unite w: Oils. This is probably owing to the great Quantity of Water it contains even in its most concentrated State. it may be united w: Alcohol tho' imperfectly to produce an Ether. it has no Effect upon Sulphur. It unites with all metallic Bodies, except Gold. Copper Iron Zinc & Tin it suspends in a fluid Form. Quicksilver & Antimony it does not readily dissolve in the Cold. Lead Silver & Bism: it only corrodes.

It unites w: all Absorbent Earths, suspending them in a fluid Form, whereas the Vitriolic only corrodes them

— The w: the Calcarious it forms a noted Salt called fixt Ammoniac. The latter of these names is taken from its being obtained by Distillation w: the common Ammoniac, and the former from its Fixity, which w: is a property not applicable to any of the other ammoniacal Salts.

It unites w: water, and purifies air like the ~~Neutral Salts~~. Nitrous & Vitriolic Acid.

It dissolves Animal, and Vegitable Bodies, but by not dissolving Oils it does not change their Colour to black. on this Acc: it is much employed by Anatomists in making preparations of injected wax.

for when the acid is applied it entirely dissolves the flesh, and leaves y^e^ wax in the exact shape of the part injected.

We think it proper here to mention a very peculiar menstruum formed of the nitrous and muriatic acids viz: ch from its power in dissolving y^e^ Rex Metallorum Gold has been called Aqua Regia. It may be produced by adding two parts of nitrous to 1 of muriatic acid or vice versa. This Diff: erence of proportions occasions no Chang in the Properties of the mixture. it may also be produced by adding one part of common salt to 4 parts of nitrous acid

It may also be obtained by adding Muria-
-tic Acid to common Nitre. This will ap-
-pear a paradox to many according to
the Laws of Elective Attraction, but may easily
accounts for it upon rational and
obvious principles. he observes 4ly: the
Practice will not succeed except in a
very considerable Heat, when a Suffici-
-ent Quantity of Nitrous Acid to form an
Regna Regia will be decompound & raised
w: the Muriatic. It acts upon most
Bodies nearly in the same manner as
the Acids which compose it. Only it is a
much more powerful Menstruum for
all Metals. we are naturally led hence to

enquire w^h are the Effects of other Acids com-
-bined? It is to be suspected since we see
such remarkable Effects of their Combi-
-nation in dissolving and inflaming
Oils, that important Discoveries might
arise from such Inquiries.

Of Vegitable Acids

They are native Substances found uni-
-versally in Vegitables, and perhaps in
Vegitables only. D^r Boerhaave enu-
-merates 5 kinds of this Acid, but I
think they may very properly be
reduced to 3. viz: the native, the
Fermentive, and the Distilled.

Native Acid is obtained from vegitables as Lemons by simple Expression. In this State it is so very dilute, that if kept for any long time it would run into a putre-factive Fermentation. This however may be obviated by Rectification, after which it is called Rob. The general Rule directs us to evaporate till the Substance is of the Consistence of a Syrup. but the Process cannot be extended so far, without chan-ging the peculiar Flavour of the Acid. we may remedy this by evaporating less of the Water, and by the Addition of Alkohol which w: is extremely convenient not only as an Antizymic to prevent Fermen-tation, but as it is always mingled w: in

Rob for the usual purposes of our Economy. —

Fermentive Aids.

We shall omit saying anything concerning the production of this Aid, 'till we treat of the general Theory of Fermentation under the Head of Alkohol. —

This Aid is always considerably diluted w: water. it may be rendered more concentrated by Distillation, as directed in Macquer: but this practise will not sufficiently dispel the water without giving the Aid such an Empireuma as renders it unfit for any Economical

Nos. Another method has been proposed of combining the Acid w: a Metal in form of a Salt, and then distilling from the Crystals. but even y^e^ few Metals y: can be combined w: the Vegitable Acid, make this proposal of but little use. For Example, if it is combined w: Lead into a Saccharum Saturni, and subjected to a Distillation, instead of a concentrated Acid, we shall get an ardent Spirit. Iron also changes the Acid. Zinc will not dismiss it without a great deal of Heat. When combined with Copper into verdigris it may be obtained very much concentrated, but then it cannot be used w: safety for Medicinal purposes, upon acc:

of the deliterious Effects of the Copper or
Zinc, some of whose particles we can-
-not prevent by any precaution from
rising w: the Aird in Distillation.

After repeated Experiments we think the
best Method to accomplish this Desideratum
of the Chemists is to expose the Vinegar to
Cold 8, or 10 Degrees below the freezing
point, carefully taking of the Pellicles
of Ice which form upon the Surface. these
Pellicles contain chiefly water. by this
Method I have reduced four pints to half
a pint, and in colder Climates it may
be practised w: greater Advantage. the
Practice will not be successful when

the Cold does not descend to 22°. or 12°
below the freezing point.

One Ounce of vegitable fixt Alkali
saturates 2 oz. of vinegar. This Combinᵗⁿ.
produces about two Ounces of Regenerated
Tartar, from which we may Obtain in
Distillation a very concentrated vegitable
Acid by the Addition of the Vitriolic.
The portion of the latter w^ch. necessarily
arises in Distillation may be extricated
by Predistillation w^th. a fresh portion
of Vitriolic Acid.

Distilled Acid

Is Obtained from the Distillation of
vegitables Viz. the Fir contains

this acid in great abundance, and thus
is generally employed in the following
manner. The Retort is filled w.th the Chips
of the Fir, and a sand heat applied gra-
-dation. in the first part of the Distillation
a water arises. after that an acid - then
an Oil w.ch is the Essential Oil of the Fir, &
lastly an Empireumatic Oil resembling
Tar. These Oils being seperated by the
means employed under the Head of Sepa-
-ration, the acid must be concentrated
by a second Distillation. This B is the
same acid as that present in Tar wat.
and contains all its Medical properties

Dr Berkly Bishop of Cloyne who is a
strong Advocate for the virtues of Tarwater
directs us to use Norway Tar rather
than American. The Cause of this prefe-
-rence is not on Acc.t of any peculiar
quality in the former, but from y.e Quanti-
-ty of water w.ch w: the Norwegians adulte-
-rate. Whereas the Americans are allowed
a Bounty for the Importation of Tar as
free as possible from water & Impurities
of all kinds.

The Production of Tartar which is a
Vegitable Acid shall be considered under
the Head of vinous Fermentation.

Properties of Vegitab.e Acids.

There is some variation in the Relation

of these several Species to be established
to other Bodies, tho' they are not dis-
-tinctly ascertained by Experiment.
This Acid unites w: Acids - and w: Alkalis
forming neutrals w: the latter, with
this Difference from the other Acids, that
no Effervescence succeeds the first Addi-
-tion, but as the Mixture approaches to
Saturation the Effervescence encreases.
It admits of no union w: Inflama-
-bles except Ardent Spirits, w: which in
a very concentrated State it may be com-
-pletely combined.
It unites w: several Metallic Bodies

as Copper, Lead Zinc, and as Dr Lewis
& Mr Margraaf inform us in a very
small proportion w: Tin. it corrodes Iron
and Antimony, and indeed there are
few Metal: Substances w: may not be
dissolved by Vegitable Acid if applied after
Precipitation from other Acids.

It may be combined w: all 4 Lactics
are Soluble in other Acids

When highly concentrated it generates
Heat with water and Cold w: Ice.

It acts upon Animal & Vegitable Sub-
-stances as a powerful Antiseptic and
renders Animal Fluids less coagulable,

Whereas the Other Acids very much pro-
-mote their Coagulation. This Circum-
-stance perhaps depends more upon the
Redundance of the water with which
this Acid is always diluted, even in its
most concentrated State, than upon
any peculiar Property of the Acid.

Of Acids in general.

All Acids retain their Fluidity more
strongly than water, tho' in certain De-
-grees of Cold they may be rendered solid.
The more any Acid is concentrated the more
its freezing point encreases. Acids when
quite pure are of much greater Specific

Gravity than water. this however is di-
=minished in proportion to the quantity of
water present, so that probably if we could
obtain them perfectly free from foreign
matter, their Specific Gravities would be
equal. In Acids also of equal Degree
of purity neither the Colour Taste nor Odour
can be distinguished, but seamentirely
to depend upon extraneous matter.
These Facts are favourable to the Opinion
of some who think there is but One prima-
=genial Acid in Nature.

It is the general property of all Acids
to unite with Alkalies forming Neutral
Salts in w: prop: the properties of neither

simple Ingredients before mixture.
Acids join with Alkalies producing
Heat except when very much diluted,
at which State they generate Cold with mild
volatile Alkali. The Reason of this perhaps
is That the Cold generated by y^e Alkali &
water exceeds the Heat generated by y^e Acid
& Alkali. The different Acids require
different proportions of Alkali for their
Saturation. M^r Homberg has endeavoured
to ascertain these proportions, yet his Ex-
periments for this purpose are very inac-
curate. First because he determines the
power of Saturation by the additional
weight of the Alkali after mixture,

without considering that the Acid supplies also the weight of the fixt air which es-capes in Consequence of the Union. a second Objection to his Experiments is, that he examined the Salts in Crystals, which we shall prove to contain a large proportion of water. we can however the w: Certainty affirm that y: Acids re-quire more or less of Alkali for their Saturation.

The Or and Or unite w: all y: Oils except the Presence of some foreign matter prevents the Combination. hence probably the Reason why the Muriatic and Vegitable Acids do not dissolve Oils be-cause

we never can obtain them but in a very dilute State. we are somewhat confirmed in this Opinion, since the Nitrous and Vitriolic Acids may be entirely deprived of their power to dissolve Oils by a proper Dilution w: Water. The Oil and Oil also unite w: Alcohol, but if considerably diluted they become as incapable of such an union as the Muriatic or Vegitable. — None of the Acids unite w: Sulphur. all Metal: Substances may be dissolved by the Acids either seperately applied, or in Combination w: each Other. The Effects of Acids upon M S: as

extremely opposite. E.g: The Vitriolic Acid will not dissolve Copper except in a highly concentrated State, whereas it will not dissolve Iron except in a very dilute State.

All the Acids unite w: every Species of Absorbent Earths.

When highly concentrated they all attract water from the dryest Air.

Acids dissolve all or some of the Ingredients in every Animal & Vegetable Substance destroying their Texture & changing their Colour more or less to a black. They are very powerful Antiseptics, and coagulate most of the Animal Fluids.

From this comparative & general view
of the Acids we are led to conclude 1st:
the Opinion of some is not improbable
who suppose that there but one pri-
-mogenial Acid in Nature, and 2d: 4th diffrent
Species which we can examine are no-
-thing more than various modifications
of this Acid with foreign matters. we
have never been able as yet to discover
the Substances which produce 4th diffrent
Acids. we can only determine with Cer-
-tainty that they contain water, Air
& perhaps an Inflammable principle.
Some Chemists have thot 1st: the O
is the Primogenial Acid, but this Opini-
-on cannot be supported since we are

ible to analize it into its different parts.
Mr: Stamberg on the other hand not only
denies that any of our Acids are truely
primitive, but also describes the Bodies w:h
he supposes combine w:h a primitive Acid
in the Formation of the four. he says y:h
there are three kinds of Sulphur. viz: -
Bituminous, Metallic & Vegitable. y:e
a primogenial Acid united w:h y:e first of
these produces the Vitriolic - w:h the 2:d the
muriatic, with the 3:d and last the nitrous
and Vegitable. this Opinion of Stambergs
is not quite so chimerical as might at
first Sight appear. for the Ox seems to
have the strongest Relation to Bituminous,

the ♂ to Metallics and the ♀ and ☿
to Vegitable Bodies. we shall not how-
-ever be able to prove a primogenial
Acid till we can transmit them into
each other.

There are other Acids different perhaps
from any we have mentioned. the Acid
which arises after the Dissipation of the Bil
& water of Animal Bodies - phosphorus
of Urine - the Acids of Arsenic - Amber
Borax and of several Bituminous Bodies
seem to be each a seperate & distinct
Species: but as their Chemical History is
not sufficiently established, we shall enter
upon it here, but proceed to y^e^ Division of
the saline Bodies called Alkaline.

Of Alkalies in general.

There are three Species of Alkalies viz:
the Vegitable, the Fossile, & volatile.
a Definition of them may be seen
under the general head of the Objects of
Chemistry. These are again subdivided
in Caustic and mild. in the latter state
they produce a violent Effervescence with
Acids, which has procured them the Appella-
tion of Effervescent. but in the latter
no Effervescence succeeds the Union, hence
Caustic Alkalies are called non-Effervesc-
cents — the mild Alkalies contain a great
Quantity of fixt Air. upon the Application

Of Alkalies

Transfon of Acids this Air escapes rapidly
in an Elastic State, and produces the
violent Commotion in the Mixture
which has been called Effervescence.
Alkalies become Caustic When deprived
=ved of their Air. if these Acids are
applied to them in a perfectly
caustic State, it is evident, no Effer
=vescence will attend their Union, be=
=cause the Alkali is deprived of any Air
which the Acid could restore to an Ela
=tic State.

First Alkalies attract Air more strong
=ly than the Volatile, Wherefore if Air

add a portion of Caustic fixt Alkali to mild volatile, the fixt by receiving ye Air becomes mild, and the volatile by loosing it becomes Caustic. this Experiment may be reversed. as may be seen in Mr Bridé's Experiments. &c

Caustic Alkalies dilaquesce readily in the Air, especially the volatile which can scarcely be obtained Caustic in a Crystalline State. Quick Lime is a saline Substance rendered mild by Calcination, and is upon that acc: employed for rendering mild Alkalies Caustic.

Of the Vegitable fixt Alkali.

This is an Artificial Substance procured by Art chiefly from the Incineration of vegitables. It is as yet a matter of Doubt whether this Alkali formally exists in vegitables, or whether it is generated in Incineration. It may easily be obtained from Nitre, but this Practice suits the Private Chemist only, being much too expensive for large works. Since therefore a Practice upon vegitables is most universally interesting, I shall chiefly confine myself to the Description of it.

The Private Chemist ought to

Of the veg.ble fixt Alkali

make use of German pot-ash, which is an Alkali calcined after being obtained in the Common Method. but for large works we may chuse promiscuously any vegitables which the Climate affords, except the very inflammable & resinous woods. for these yeild by Incineration an inconsiderable quantity of Alkali occasioned either by the lesser Quantity present, or a Dissipation from a Quick Inflamation of such vegitables. I am inclined to think it depends upon the last circumstance.

During the Calination of vegitables we must not admit too much Air, least

it dissipate the Ashes, nor entirely ex-
-clude it Otherwise the most intense
Fire will reduce the vegitable matter
only to a Charcoal. The Ashes being
prepared we must lixiviate them in
Pots w^th^ water, we extract three or four
Infusions from each tub, and y^e^ last if
very dilute may be returned upon the
next tub. The Ley is to be collected from
the Pots, and the Alkali obtained by
Evaporation. Care must be taken
in evaporating this Ley always to keep
it of an equal Height in the Vessel that
as much Salt is precipitated as the
Vessel will conveniently hold. For if an

Of the veg: fixt Alkali

evaporate to Dryness, the Alkali concretes so hard to the vessels, that in beating it off we shall hazard their safety. In several parts of England they Obtain the Alkali from the Incineration of Straw wh: has been infused in Ley. But as the Straw is then very difficulty inflamed we can:-not procure the Alkali free from part of the Phlogiston of the Straw.

Tartar which is produced by vinous and Acetous Fermentations affords fixt vegitable Alkali in greater proportion & Purity than any Body whatsoever: it will also contrary to all vegitable matter suffer a Calcination tho' excluded from

the external Air.

The Practice for obtaining this Alkali from Nitre is fully described by Mayer. It is done by deflagration w.th Charcoal, and all mettalic Filings except Gold and Silver, and w.th Tartar which absorbs the Acid from the Nitre. if 2 p.ts Nitre and Tartar are added in such proportions as that the Acid of Nitre may sufficiently carry off the Phlogiston of Tartar. the Residuum will be, from the Nitre a pure Vegt. Alkali, and from the Tartar a white powder called White Flux. but if the Quantity of Tartar predominates greatly, we shall obtain after Deflagration, from the Nitre an Alkali as

Of the Veg: fixt Alkali

before, but from the Tartar a dark colour-
-ed mass called Black Flux. —

Fixt: Veg: Alkali is always more or
less Caustic, in proportion to y^e Heat em-
ployed in its Calination, tho we cannot
render it perfectly so by Fire, because in
a certain Degree of Heat it fuses, and then
parts w^th its Air very difficultly. in which
Heat likewise it corrodes, and passes
thro any Vessels we can employ, except
Gold and Silver, and even these will
not bear Heat enough to render the practice
convenient. Since therefore Calination
will not answer our Intention, we must

Of the Veg: fixt Alkali

employ some Body y: will attract y^e^ Air
of the Alkali, without uniting w: it.
for this purpose three parts of Quick-
-Lime added to one of Alkali is extremely
convenient. This mixture is to be stirred
in water, when the following Elective
Attraction takes place. The Quick-lime
will attract the mephitic air of the Alkali,
and the Alkali uniting w: the water is
perfectly suspended, while the Quick-lime
is precipitated in the form of Calcarious
Earth, having been rendered mild by
the Air of the Alkali. The Vessel must
at rest till the Earth subsides when the

Of the Veg: fixt Alkali

Liquor impregnated w: Alkali may be decanted. Alkali may be also rendered Caustic if mixed w: Alkali, and applied to the Fire. Another Method is to calcine the Alkalies w: their own Earth, or w: the Calces of M: except Gold, Silver & perhaps Arsenic for preventing Fusion.

N:B: When the water impregnated w: Alkali is decanted we must seperate them by Evaporation to Dryness.

The Caustic Alkali however remains but a very short time in a dry Form, becaus it dilaquesces & y: very rapidly. on this Acc: It is almost impossible

Of the fixt veg: Alkali

to preserve a Caustic Alkali in a dry or Crystallized form, for any length of time; but when it is mild it readily converts into firm pellucid Crystals. The best way of getting fixt Alkali perfectly mild is to expose it in broad shallow vessels to the air, from whence it will attract a sufficient quantity of air & moisture for its Crystallization, or it may be done by holding the Alkali over a steam of fermenting liquor.

Properties of fixt veg: Alkali

It always has a peculiar acrid taste, more or less as it is Caustic or mild.

Of the first: or g: Alkali

Saliva contains an ammoniacal salt which is decomposed by fixt Alkali. Hence the urinous taste which some Chemists have described. it is of a snow white colour when perfectly pure. it emits no sensible odour. it deliquesces when caustic but concretes firmly when mild. in either state it unites w: all the Acids without any difference in the neutral salts produced by each. it effervesces w: them in a mild state only. it has a stronger attraction to Acids than volatile Alkali.

It unites w: Oils forming Soaps. but when it is perfectly mild there are many

Of the Vegetable Alkali

with which it will not unite, and hence the use of Quick-Lime among the Soap-Boilers. it unites w: 2lb highly concentrated Alcohol only when Caustic: but if the Alcohol be very dilute, the Alkali will unite w: 2lb of water of the Alcohol, and remain separate. hence the use of Alkali for concentrating Ardent Spirits. it unites intimately w: 7lb Sulphur forming a Soapy Hepar Sulphuris. any of the Acids decompose this, and produce a peculiar fetid Odour.

It dissolves some of the Metallic Bodies

Of the 1st & 2d fixt Alkali

except Lead and Copper in their proper Form: but unites w: most of them when precipitated from Acids. it disposes M.S: to Fusion and then unites w: all of them.

- its Effects are most considerable upon Ores, because they usually contain a large quantity of Sulphur which w: 1st & 2d Alkali produces Hepar becomes a very powerful Flux to Metalic Substances.

It unites w: all Earthy Bodies, and acts powerfully as a Flux, rendering some fusable which alone are absolutely refractory. If applied Caustic to a Solution of Calcarious Earth in Acid, the Earth will

be precipitated in a perfect State of Quicklime. Hence we may draw two Conclusions 1st That the Opinion of Some is groundless who suppose that remarkable virtues are imparted to Quicklime during Calcination, and 2dly That saline, Earthy and perhaps Metallic Bodies are suspended in Lixivia in a Caustic State or in other words deprived of their fixt Air.

The Affinity to Air and Water is evident from its becoming mild when exposed to the Atmosphere. Caustic Alkali may be dissolved in equal portions of water, but when perfectly mild

Of the Veg: fixt Alkali

it is not soluble in less than 8 times its own weight.

Caustic Alkali in Solution dissolves Animal and Vegitable Substances of all kinds. - when it is not very caustic it acts chiefly upon the Glaginous and Juicy parts of those ~~Vegitables~~ Bodies in which their Colour usually consists, and hence the Foundation of its use in the Art of Bleaching. [For an Acc^t of its Oeconomical Uses in Black's Chemistry Vol: 2 -]

Fixt Fossile Alkali

Is a native substance very generaly dis-
-persed thro the Earth, either in a
Separate or Compound State. it is y:
first of these it is found efflorescing from
the walls that are exposed to cold and
Moisture — in a pure crystalized state
in the Earth, and according to Stahl
& Hoffman in the Springs called Alc-
-aline. — In a compound State it is
found in an Earth near Smyrna ca-
-lled Soap-Earth — in Borax — Glauber's
& common Salt. This Alkali seems to
be w^ch the Ancients called Natrum or
Nitrum, from the great Analogy be-
-tween

Fixt fossil Alkali

the Definitions given of the former, and the well known Properties of y^e^ latter. I shall give only an Illustration of this Matter. Solomon says "to sing songs w^th^ a heavy Heart, is like the mingling of Vinegar and Nitre" — If we suppose he meant the Neutral Salt which we call Nitre, the Allusion is no way striking. But if we suppose he alluded to y^e^ Conflict or Effervescence w^ch^ would attend the Mixture of Vinegar w^th^ an Alkali, y^e^ Figure is beautiful, and worthy the great Author who wrote it. —

The Arabians who lived upon the Sea Coast obtained their fixed Salt from

First Prof. Alkali

maritime productions entirely, especially
a Plant called Kali. This Practice was
long confined to Arabia & Asia, but
it is now common in many parts of
Europe especially upon the Coasts of
Spain bordering upon the Mediterra-
-nean, where the proper plants grow
very plentifully. After this Practice
was communicated by the Arabians
to the Europeans such of the latter as were
contiguous to the Sea Coast obtained
their Salts from any vegitables which
the Country afforded, and consequently
got the Org: first Alkali. This they called
from the word Kali alkali but made

Fixt Fossile Alkali

no Distinction between the Fossile and Vegitable. M^r Boyle observing some Diffirence in the common Alkali and that imported from the Levant stated some Conjectures w^ch Respect to two Species of fixt Alkali. D^r Stahl recommended to his Pupils an Investigation of the Properties of each. this however was neglected till M^r D^r Hamel published a Dissertation upon y^e Fossile Alkali. this excited Chemists of other nations to make Inquiries, and it is now universally allowed to be a distinct Species of fixt Alkaline Salt.

Methods of getting the Fossile Alkali

In Britain all Vegitables which are

First Fossile Alkali

found upon the Sea-shore are employed
for this purpose. They are dried incine-
-rated, lixiviated &c, according to the
Directions given for Obtaining Vege-
-table Alkali. The Alkali Obtained is
a concrete mass, contains a portion
of Common Salt, Glauber's Salt &
inflammable matter. This answers very
well the purposes of several Mechanicks
as Glass makers - Soap Boilers &c. but
if we require it in a very pure state
for nice Operations, we must calcine
the Alkali brought from ye Mediterranean
which is Abundantly more free from

First Fossile Alkali

extraneous matters than y: common
British Kelp.

As this Alkali is the Basis of Common
Salt, and Sal Glauberi, we may get it
from either by proper management. if
we use the former we must add nitrous
Acid, w: decomposes the Acid of y: common
Salt, and unites w: its Alkali into a Cubic
nitre. this must be deflagrated with
Charcoal when the nitrous Acid will exhale, and the Alkali remain separate.
Glauberis Salt deflagrated w: Charcoal
forms a Hepar sulphuris from which
the Alkali may be attracted by any
Acid. the Vegitable is best, because it

may be more readily dissipated than
any other. The Fossil Alkali more eas-
-ly crystalizes in a Caustic State than
the Vegetable, but since the latter
may tho' w. much Difficulty, be ob-
-tained in a Crystalline Form, that
Property cannot be a universal mark
for distinguishing the two as some
Authors have alledged. When these
Crystals are exposed to the Air, and
-ined powder appears upon their Sur-
-face, w. ch soon afterwards deliquiates.
It is less soluble in water than y.e Veget-
-ble, and will not unite w.th it even in

First Fossil Alkali

Fusion. It unites with all the kinds like the vegitable, only producing diffirent neutrals. Their Effects upon Inflammable, metallic, Earthy, watery, Animal & vegi=table Bodies are very exactly similar.

This Alkali has been called Nitrum Ægyp=tiacum to distinguish it from y^e^ neutral Salts. The Spaniards call it Soda & Barul=la from two plants of that name w^ch^ afford it. The Italians use it in a concrete impure State, when they call it Rochetta, or in a purer powdery Form when they call it Pulverina. The grofs concrete Alkali prepard in Britain is called Kelp. we

Fixt Fossile Alkali

also import it much purer from the Town of Alicant, which is distinguished by the name of Alicant Kelp.

Of the volatile Alkali.

This Substance is obtained by artificial means only being never found in a native state. When two Stones are struck briskly against each other, a Smell arises which some Chemists have not similar to that of volatile Alkali, and hence affirmed that it was a Fossile Substance. But if such an Odour can be observed after the Collision of two Stones, we should rather suppose that it was collected by the Stones which during Concretion might have entangled various Animal and

volatile Alkali

Vegitable substances which always
contain a volatile Alkali, & this in a
much greater proportion when they are
subjected to Putrefaction. It is found y:
the solid parts of Animals afford this
Salt in the greatest abundance; and
Chemists have thot that Hearts-horn affor-
-ded a kind of peculiar Excellency, & them
the general Term Sp: Cornu Cervi. It is no
however known that the Bones, Horns
Hoofs &c of Animals under proper manag
-ment produce volatile Spirits similar
y: of Hearts-horn, w: ch pass under y: Original
Name of Sp: Cornu Cervi. The Practice

Volatile Alkali

upon Animal and Vegitable Substances is performed by Distillation Alone, and only proper for large works. Common Ammoniac is a Subject from which this Substance may be most readily Obtained by the private Chemist. The Process is to be carried on by Distillation w.th fixt Alkali, Calcarious Earth, or Metallic Substances. I mention the latter rather to inform you of the Fact than to recommend y.e Practise w.th Metal. Subs.ce — Calcarious Earth is best because it gives y.e Alkali in the most firm Condition. if 3 pounds of Calcarious Earth be added to 4 lb of Sal Armon.c we shall obtain in Distillation

Volatile Alkali

One pound of Alkali in a Volatile sta-
- this great proportion of Vol: Alk.
has long been a matter of Admirat-
-on to the French Chemists; but I
think the Phaenomena may be
solved by considering that 1/2 Alkali
of the Ammoniac is in a caustic
state, that 1/2 Calcarious Earth &c.
-composes it, and unites w.th the Acid,
& that 1/2 Alkali absorbs the Air
calcicated from the Earth during its
Combination, w.ch Absorbtion not only
renders it mild, but encreases its weight
also. This Opinion is further con-
-firmed

Volatile Alkali

Experiment. If to ℔ij of Sal Ammoniac be added ℔ij of Quick-Lime, or fixt Caustic Alkali, we shall not obtain a third part of the Quantity obtained in the last Operation. —

Volatile Alkali may be artificially produced from a combination of all the Acids (except the Vegitable) w^th^ fixt Alkali. — Thus if we collect the Fumes of Nitre, a fixt Ammoniacal Salt composed of Muriatic Acid, and Calcarious Earth, or Hepar Sulphuris when deflagrated w^th^ Charcoal. May all afford a volatile Salt. Vitriolated Tartar digested w^th^ Alkohol produces a Vitriolic Ammoniac

Volatile Alkali

From which we can get the Volatile Alkali

Volatile Alkali when mild readily admits of a Crystalization. it will crystalize when it is not perfectly mild. but when it is more apt to dilaquesce. when perfectly Caustic it can be obtained in a fluid Form Only. it emits pungent Odour when mild, and in its perfectly Caustic State, it is one of the most powerfull and volatile Bodies we are acquainted with.

It is dissolved in Acids with the same Phanomena as fixt Alkalies. forming peculiar Neutral Salts distinguished by the Epithet of Ammoniacal. As

Volatile Alkali

more weakly attracted by Acids than fixt Alkali, magnesia, Calcarious Earths & Metallic Substances.

When mild it does not unite w: any Inflammable Matters; but in its Caustic State it unites w: ℞ all. this Union however does not seem complete, for it soon recovers Air from them & Effervesces. it unites w: ℞ Sulphur by Solution, and they both rise in Distillation.

Its Effects upon Metallic Bodies are not sufficiently ascertained, yet we know that it dissolves Copper, & several other Metals when precipitated from Acids. —

℔ does not unite w: any Earths.

Mr Duhamel supposes that ℔ & Alkali of

Volatile Alkali

Ammoniac is blended w: ℔ i earth, because if ℔ i of Ammon: be distilled w: ℔ ij or ℔ iij of calcar: earth, we shall obtain ℔ i of volat: alkali, but we have already explained this upon much more Obvious Principles.

Its Effects upon Animal & vegitable Bodies are the same as those of fixt Alkali, and it is reckoned a more powerful Antiseptic.

It generates cold w: ℔ i water when very dilute and mild: but when Caustic and pure it generates Heat like other Alkalis.

When this is obtained from Animal Bodies, it is called Sp: C. Cervi — when from Ammoniac Sp: Ammoniac.

Volatile Alkali

Sal volat: Sp^r Ammoniae cum Calce viva. —

Some Chemists have imagined and not improbably that as there is only one primogenial Acid, so there is but one primogenial Alkali; different modifications of which appear to us as distinct species of Alkali. —

Of Neutral Salts.

Neutral Salts are produced by a mixture of an Acid and Alkali to the point of Saturation. These have been called by the Chemists Sales Salsi, because each of the Ingredients are saline. Sales medii as it Compound was in an intermediate State between the Acid and Alkali, but since their Properties are entirely changed. Ho a tertium quid produced, I think the best Epithet that we can give them is Neutral. Chemists have expressed great Anxiety about determining the point of Saturation. Tho' in general

Neutral Salts

In this we need not be very exact w: Respect to the proportions added, provided there is excess of the Acid. Some Neutrals however require a very nice Adjustment of the point of Saturation: we may therefore add red or blue coulouring Veg: or Paper tinged w: the Juice of these; if the Acid prevails the Colour will be=come red, - if the Alkali the Colour be=comes green, but if the Mixture is per=fectly Neutral it discharges the Colour altogether. These Salts are often formed by employing mixed Bodies as shall be shewn more fully hereafter.

Neutral Salts

Neutral Salts when formed may be decomposed by various means, and many by the Force of Fire alone. But the Neutrals formed w: Nitriolic Acid, and the Ammoniacal Salts cannot sublime altogether than Separate, when Subjected to Heat. Some of them may be decomposed by Deflagration w: Inflam: matters, & many by Elective Attraction in Consequence of the Addition of Acids. —

The Nitriolic Acid having the Strong Attraction to Alkalies, may decompose all the Neutrals formed by y Nitrous

Neutral Salts

Muriatic acid Vegetable. the Nitrous decompose those formed by y Muriatic & Veg: ble — the Muriatic those formed by the Vegetable Only. for the particular Neutrals formed by the Acids & Alkalies. see the Table at the Beginning of Your Chemical History.

The Ammoniacal salts may all be decomposed by fixt Alkalies & with lime &c. — we shall now proceed to Treat of the particular Neutrals, in the Order observed in the Table before mentioned.

Vitriolated Tartar

This Salt compound of Vitriolic Acid & fixed Vegitable Alkali is perhaps entirely an Artificial Production. Some have thought it was a native Substance, because it has been found in Ashes of Vegitables after Incineration - but since it is never found in whole Vegitables we may w: more probability suppose that its Formation depended upon an Acid imbibed from the Air, or to a peculiar Effect of the Fire. —

There are four Methods of forming this Salt - 1st By taking y^e Acid & Alkali both in a Separate State, 2nd: By taking

Vitriolated Tartar

the Alkali Acid in a seperate, and the Alkali in a miat State. 3.ly By taking the Alkali seperate, and 2.ly: Acid miat & 4.th By taking two Compounds. this will be illustrated by the following Table in which all the Bodies are enumerated w.ch we can employ in the 4 Cases mentioned for Obtaining Vitriolated Tartar.

Case 1.st ½ Vitriolic Acid — — first beg: Alkali

Case 2.nd
- Vitriol: Acid — — Nitre
- ——— — — Digestive Salt
- ——— — — Regen.d Tartar
- ——— — — Ashes of beg: Alkali
- ——— — — Regar Sulphuric

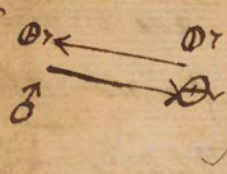
Case 3.rd
- Vegitab: Alkali — Vitriol: Ammoniac
- ——— — — Vitriole
- ——— — — Earths w.th Vit: Acid
- ——— — — Sulphur.

Vitriolated Tartar

Case 4:th { vitriolic Ammon: — { neutrals of veg: alkali.
{ Vitriols
{ Earth: w:th ~~veg: alkali~~ — — —
{ Sulphur — — — — nitre

In the 4:th Case the Practise is very inconvenient; for when y:e Vitriol: Ammoniac is applied to neutrals containing veg: alkali, as for Instance Nitre, the Acid of the Ammoniac unites w:th the Alkali of the Nitre into a Vitriolated Tartar, and y:e Acid of the Nitre forms w:th the Alkali of Ammoniac a Nitrous Ammoniac w:ch must be seperated by sufficient Degree of Heat. if green Vitriol be applied to Nitre y:e following

Vitriolated Tartar

double Elective Attraction will take place. - gree of that  and the de- necessary to seperate ~~the combination~~, the Vitriolated Tartar from the new Combination of Nitrous Acid & Iron will be found extremely inconvenient. In the same manner we might draw Schemes for the Combinations w: h: form all the Neutrals: but we shall leave them to yourselves by way of Exercise, and proceed to consider w: is the best Method of Obtaining Vitriolated Tartar.

The Combination of the Acid &

Vitriolated Tartar

Alkali as in Case 1st may seem y^e last, but y^e point of Saturation is so diffi-cultly hit, that it is almost impos-sible to obtain it pure this way. Com-mon sense of this Inconvenience practise upon some of y^e Subjects in Case the 3^d which will yield no more of their acid than is just sufficient to saturate the Alkali, we thereforeob-tain a vitriol. Tartar by this means extremely pure. Sulphur deflagrated w^th Nitre gives a volatile vitriolic Acid which unites w^th the Alkali of the

Vitriolated Tartar

Nitre (its Acid being dissipated w.ᵗʰ the 2/4: Inflammable principle of the Sulphur) & forms a Salt called Polychrestum. this is much more soluble than Vitriolated Tartar, and ought perhaps to super-sede it in all Prescriptions. immediately after the Deflagration we must secure the Salt in very close vessels. for any means w.ᶜʰ we can practice for purify-ing this Salt will also render it upa vitriolated Tartar by restoring its Acid to a fixt state. —

Chemists have given various Appellations to this Salt as Obtained

Vitriolated Tartar

from different Subjects. When Obtained from Nitre and Vitriolic Acid, it is called Nitrum Vitriolatum. When Obtained from the Matter in Case it has been called Sal Mirabile Perlatum. Sal Duobus. Arcanum Duplicatum. Panacea Duicis Helvetii When prepared w: Antimony it is called Nitrum Stibiatum. When prepared from Sulphur & Nitre it is called Sal Polychrestum. This is Nothing more than a Vitriolated Tartar when Acid is in a Volatile State.

Vitriolated Tartar.

The Properties of this Salt are as follows.
It is of a remarkable firm Concretion,
— of difficult Solution in Water — assumes
the form of hexagonal Crystals; it is the
most difficultly fused of any Salt whatever
— with a small Degree of Heat it decrepi-
-tates. it may be decomposed by Phlo-
-giston w^h converts it into Hepar Sul-
-phuris. When Vitriol. Tartar is ap-
-plied to a Solution of Silver in Ni-
-trous Acid, a Decomposition will take
place in Consequence of an Elective
Attraction described in ^the^ following Diag^m^:

Vitriol Tartar in the Palm of the hand. —

This is a true Solution of Dr. Ethal's problem for decomposing =

Of Glauber's Salt.

This is a native Substance composed of Vitriolic Acid & Fossile Alkali. it may be also produced Artificially by the various Combinations mentioned in 4th Table of Vitriolated Tartar, which Table will serve likewise for Glauber's Salt if we substitute the word "Fossile Alkali" in the Room of Vegitable. but the most convenient Method is by Distillation w.th Common Salt and Vitriolic Acid. in this process 4th Vitriolic Acid decomposes the Acid of Common Salt, which must be dissipated by Heat when the Vitriolic will be left

Glauber's salt

combined w.th the Fossile Alkali. y.e Neutral thus formed differs considerably from Vitriolated Tartar. The latter crystalizes very firmly - is difficultly soluble in water & extremely fixt in the Fire. y.e former is of a very loose texture, easily soluble in water, and very fusible in Fire. Vitriolated Tartar receives a small proportion of water into its Crystals, Glauber salt the greatest of any Neutral whatsoever. This salt calcined & added to water forms a Coagulum provided free access of the external Air be admitted. - It may be decomposed by y.e same methods as vitriolated Tartar.

Common Nitre

This Substance was quite unknown to the Ancient Greeks and Romans. — The Arabians first manufactured this Salt, and by them it was introduced into Europe. It is now chiefly imported from Asia. Tho' whether it is an Artificial or natural production we are not certainly informed. Probably the former because it is never found native in Europe. The most Authentic Accounts we have received concerning y^e Production of Nitre in Asia is, that in a dry Season they use fire to y^e Operation or

Surf of their Land. When Rains fall the Alkali produced is washed to a small Depth in the Earth, where it meets with a Nitrous Acid. The Earth thus impregnated yields its Nitre by Lixiviation & Evaporation.

To obtain Nitre most conveniently in Europe, we ought to chuse a Clay Soil as a Matrix. This Ought be impregnated with Animal, and Veg: Bodies as strongly as possible. The Putrefaction of these is greatly expedited by the Addition of Lime. This Matter will also resolve the viscid tenacious Texture of the Clay which might otherwise inve-

-lope

part of the Salt. common Salt added to that putrescent matter is in some measure converted into Nitre, and never fails to be generated more or less during the Putrefaction. This matria must be exposed to the Air by as large a Surface as possible, and defended entirely from the Rain: so essentially necessary is the Air not only to Putrefaction, but to the Generation of particular saline matter, that we not find the Matrix impregnated even for use at more than an Inch from its Surface. The Salts generated by those putrescent

matter will be volatile Alkali, and Ni-
-trous Acid, forming Nitrous Ammoniac.
- If then we lixiviate it w: strong fixt
Alkaline Ley, it is evident y: by Evaporation
we may obtain a Common Nitre, in
Consequence of y: Decomposition of y: Am-
-moniac. in this Procss a portion of
Common Salt will be produced, which
by a proper Crystalization may be se-
-perated from the Nitre.

Spring, & Autumn are proper Seasons
for the preparation of Nitre, because Pu-
-trefaction is retarded by y: violent Cold
in Winter, and the Saline Matter when
generated an exausted by the intense heat

Common Nitre

of Summer. hence we see ye Reason why in hot Countries Nitre is prodn. and best when its Matria is exposed to Northern winds, and at ye same time we see the Fallacy of an Opinion wch some have entertained ye Nitre floats in the atmosphere from Northern to Southern Regions. ——

Cubic Nitre.

This Substance composed of a Fossile Alka-
li, and Nitrous Acid is very rarely found
prepared by Nature, and then very near
the Surface of the Earth only. This con-
firms the Opinion that Nitrous Acid
never exists independant of putrid Ani-
mal or Vegitable Matters. a great
quantity of this Acid is certainly washed
into the Bowels of the Earth; yet we
never find it under any Appearance,
but at a very small Distance from the
Surface of the Earth. this leads us to sus-
pect that by the Oeconomy of y^e Earth.
Nitrous, after passing a considerable

Cubic Nitre

Depphlegmated into the bibibasic Acid
Cubic Nitre may be obtained by adding
the Nitrous Acid to the Fossile Alkali, &
by distilling the former w: common
Salt. This Neutral comerates into Rhom
= bridal Crystals: but in other Properties
it may exactly resemble Common Nitre

Of Common Salt

Common or Alimentary Salt is a na-
-tive Substance, collected in vast Masses
in the Bowels of the Earth as in the Mines
of Lithuania & Cracow in Poland, or
diffused thro' the waters of the Ocean,
or the waters of Springs. When it is got
from mines it is called Rock-Salt or
Sal Gem, but as the Production of Salt
from impregnated waters more imme-
-diately belongs to the Business of the
Chemist, I shall confine myself chiefly
to a Detail of that Practice, only ob-
-serve here w.th Respect to the Sal Gem &c.
frequently metallic and Earthy Matters

adhere to it. we discover the first of these by the blue or green colour which they impart, and the latter by its adhesion in substance to the surface of the salts in either Case it may be purified by Elutria-tion.

Common salt is prepared from impregnated waters by Evaporation w.ch Heat of the Sun or Culinary Fires. this is very much expedited by admitting the Air to as large a surface as possible of the Liquor before, and during the Evaporation. To effect the last of these purposes we may employ large broad Vessels for the

Common Salt

first some have contrived long narrow
Houses. in them about 20 Feet asunder
are built two Floors in y^e^ form of Cisterns
for holding the water. the upper Cistern
or Floor is perforated w^th^ numerous small
Holes, thro' w^ch^ the water falls into y^e^ Cystern
below, thro' a swift Current of Air intro-
-duced by a Door in each side of y^e^ House.
— The Contrivance has been improved by
suspending Brush wood between y^e^ Floors
by which means the Surface of y^e^ water
is very much enlarged, & Consequently
Evaporation as much exhaled. w^th^ a
Convenience of this Sort we may reduce

Common Salt

the Water to a Saturated Brine, wch may be crystalized wth a small Expence of Fuel. a Method this wch is practised in Germany.

In Britain there are several Manufactures for Salt of Sea water. This is done in large Boilers wth an immense Expence of Fuel. The Evaporation either from Ignorance or Avarice of the Proprietors is generally pushed too far, whence two Inconveniencies arise 1st the Salt by too great Heat is in some Degree decomposed, by wch its Antiseptic power is deminished, & 2dly a portion of Marine Glauber

Common Salt

Salt always present in the waters of the Ocean concretes w: ℔ common salt, Whereas by a more moderate Evaporation the former would have remained entirely suspended, while the latter would have concreted in a pure State. Sea water, and Salt Springs generally contain a large proportion of heterogenous matter. This may be separated before Evaporation by Clarification w: ℔ Whites of Eggs, or Animal Fluids of any kind as Blood &c, which entirely entangles all floating matter, and coagulate on the Surface. The Salt obtained by Evaporation

Common Salt

is called Bay-Salt from the great
Quantity produced in the Isle of May
or
w: is of the greatest purity of any except
the Sal Gem of some mines. it is prow-
=red in the following manner. large
Basons or Reservoirs are formed contigu-
=ous to a Bay in that Island, & only sepa-
=rated from it by a Mole of Land. Thro
this the water filters or is driven over it
in Storms. the water thus collected is ev-
=idely exhaled by the intense Heat of the
Sun in Summer, & ye Salt left in
ye
perfect on the Bottom of ye Reservoir.
The Bay Salt of Europe is considerably

Common Salt

less pure than that of May, tho obtain'd by the same means. the Dutch purchase this, purify it, and afterwards sell it at a low price. — it is said they add a peculiar acid obtained from mild, to which the purity of the salt is attributed. but I have not been able to procure this acid.

The Residuum of common salt after boiling is called Bittern, or y^e bitter purging salt. this is composed of vitriolic acid, and magnesia. —

Common salt forms Cubical Crystals, and when pure has a fair white Colour — an agreable taste — requires 3 times its weight for dissolution

Common Salt

— never deliquesces in the air — does not easily calcine — not so readily fusible as Nitre, ~~and does~~ nor so refractory as vitriolated Tartar, and a very powerful Antiseptic. as its purity decreases all these Properties will be proportionably lessened. the Quantity of this Salt dissolved in a hot or cold menstruum is nearly the same. —

Dr. Pringle says that a large portion of this Salt acts as an Antizeumic by a small proportion expedes Putrefaction. the Dr. however is certainly mistaken, and this Error probably arose from the Impurity of the Salt which he used. —

Digestive Salt

This is entirely an artificial Substance, compound of muriatic acid, & fixt vegetable Alkali. The process for obtaining it is fully described in the Londond Dispensatory. it assumes larger & firmer crystals than common salt, but in other Respects they are nearly y^e^ same.

Regenerated Tartar

This Salt compos'd of Veg: Acid, & fixt
Veg: Alk: is prepared by Art duly &
may be procured in a very elegant
by the Directions given in ye last Edn
= on of the Lond: Dispens: — It never
assumes the Form of perfect Crystals,
but appears dry and flaky, hence it h
been called Terra foliata Tartari, & form
a particular Medicinal Property fol
Diureticum. it dilaquesces in ye Lea
& passes to the Air, dissolves in an equa
Weight of Water, & is readily Soluable. it
may be decompos'd by all Acids. it
unites w: Essential Oils — Resins — & Gum

Regenerated Tartar

of the Gummy Substances. it unites
the w: Alkohol (ch w: has been employed as a
Test of its purity) forming a menstruum
for several metallic Substances, on w:
ch
neither Substance seperately applied
produces any change. thus if a Solu-
tion of Gold be evaporated or precipi-
tated the Calx becomes Soluble in a
Mixture of Regenerated ☿ and Alkohol.

Sal Polychrestum of Rochelle.

This is an Artificial Substance com-
-posed of Veg: Acid, and Fossile Alk:
- It was accidentally discovered by one
Seignette an Apothecary of Rochelle in
France, who having used Lap: Alcali
for obtaining Regenerated Tartar, found
½: a Salt was produced of a firmer Tex-
-ture, and of less Solubility than Rege-
-nerated Tartar. He published it accor-
-dingly w: the Application of Sal Poly-
-chrestum Rochelle or Seignette. This
Salt Ch: superside Regen: Tartar in all
Prescriptions. —

Soluble Tartar

This is an artificial substance composed of the Acid of Tartar, and fixt vegitable Alkali. I find contrary to y^e^ Opinion of some that this Salt will assume a Crystalline Form if exposed to a moist Air for a sufficient length of time. Regen^d^: and Soluble Tartar, are the only fixt Alk: Neutrals y^t^ can be dissolved in Alchohol. The Combinati= =on of the latter w^th^ Alchohol, is not so powerful a Menstruum for oily Matters as some have supposed. we shall proc= =eed to mention the Neutrals w^ch^ y^e^ Acid forms with Vol. Alk: distingu^d^ by y^e^ name of Ammon^ls

Common Ammoniac

This Salt compos'd of Muriatic Acid, & Vol: Alk: was unknown to the Ancients Greeks & Romans. w: they call'd Ammoniacal Salt was nothing more than Sal Gem. There have been many Disputes whether this is an Artificial or Native Substance. I think it ought to be ranked among the former since it is never found but in Consequence of Inflammation E.g: - It is found in the Fissures of Volcanoes - of Brick Kilns, or burning Coal pits, where Soot or smoke issue. Quere, whether there are Opera-

-tions

Common Ammoniac

of Nature or Art? — It is imported to us chiefly from Asia where it is prepared from the Soot of burnt Cow Dung: that it is never drawn from the Soot of any In-flammable Fuel. — It may also be made by a mixture of the separate Ingredients. It concretes into 4 pointed Stars or Crystals. it readily dilaquesces in the Air, but becomes more firm after Sublimation. it sublimes in a very gentle Heat without Decom-position. It is Solable in Alcohol & Water, generating Cold w.ch the latter & encreasing its Quantum for other Salts. in Sublimation it renders several In flammable & Metallic Bodies very volatile. it may be de-compounded by Vit.ic Nit. Acid & by fixt Alk.s —

Vitriolic Ammoniac

This is an Artificial Substance composed of Vitriolic Acid, & Vol: alk: Vitriolated Tartar may be converted to this Substance by Deflagration w: 2lb Inflammable Bodies. It is less soluble in water than Common Ammoniac, & not at all soluble in Alchohol. it also concretes more firmly, and does not deliquesce in the Air. it Sublimes without Decomposition tho Dr Hoffman is of a contrary Opinion. Glauber assigns more Properties to this Salt than it really possesses. -

Nitrous Ammonial

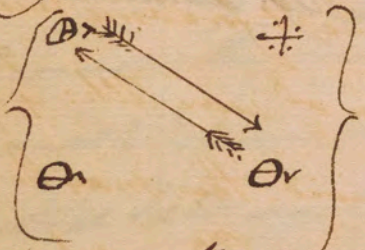
Is an Artificial Sub: composed of Nitrous Acid, and Vol: Alk: - It may like the other Ammoniacs be decomposed by Inflammation, or by Elective Attraction of other Bodies. it assumes a more concrete Texture & is readily Soluble in Alchohol or water. It is the Only Saline Body we know that is inflammable without imediate Contact of burning Bodies. The great Inflammability of this Salt seems to depend upon the Quantity of Inflamanable Matter contained in the ~~Acid~~ Vol: Alk: because the Disposition of Nitrous Ammoniac to inflame decreases as we employ a purer Alk:

Vegitable Ammoniac

This Salt formed by any Veg: Acid & Volatile Alk: is called also Spiritus mindereri. it is always very imperfect as we get it from the Shops & this demand upon the great attention that is required for producing an accurate Saturation. If the Acid, and Alk: be combined till all Signs of Effervescence cease, and the Mixture be kept for some time; upon the Addition of more Alk: & Effervesence may be renewed. this may be repeated for several times. Chemists have been very anxious to get this Salt in a solid Form. the Method generally practised is

Vegitable Ammonial

by Sublimation: but y^e Volatility of y^e
water, and Salt are so nearly equal, y^t
it is attended w^th the utmost Difficulty
to prevent both from rising. a very con-
-venient Method has been for some time
practised viz: the addition of Regenerated Tartar,
& vitriolic Ammoniac when an Elective
Attraction takes place as expressed in
y^e following Scheme. -



In Distillation the Veg: Acid & Volatile
rise, and form in the Receiver soft irregu-
-lar

Vegitable Ammoniac

Concretions soluble in water or Alkohol like Regen^{d}: Tartar it encreases y^{e} mutual power of the latter, & dilaquesces readily in the Air. — This was employd by the late D^{r}: Ward for curing indurated Swellings of the Testes. —

N:B: We must always take equal Quantities of the ~~Mineral~~ Vegitab: Acid & Vol: Alk: to produce the Veg: Ammoniac. —

Of Borax

This Substance is imported from Asia in a very impure State, & is afterwards refined by the People in Europe. tho' of the Original Production & Management of Borax we are entirely ignorant.

Some have supposed it an Alkali because it changes the Syr: of Violets green — disposes Earths to vitrify — precipitates Metals dissolved, & very powerfully promotes their Fusion. but from unquestionable Experiments it is found to be a Neutral Salt composed of a Fossile Alkali, & a peculiar Acid no where to be met with but in Borax. Chymists have

Of Borax

called this Acid Sedative Salt, and
from Mr. Homberg its first Discoverer
the Sedative Salt of Homberg. This Acid
forms tender foliated Concretions wh
are soluble in a very small proportion
only, even in boiling water. but by the
Application of Heat it becomes soluble
in Alcohol. When exposed alone to y
most intense Heat it suffers no Dissipation
but wh the Addition of water it may be
exhaled. it forms Neutrals w: all ℈ Alka
-lies, wh may be Again decomposed by
all the Acids: but the Properties of all these

Borax

except Borax are very little known & less frequently employed. Sedative salt is obtained from Borax by Distillation w: the vitriolic Acid most conveniently. the first Distillation affords a small Quantity, so that it must be 10, or 12 times cohobated before we can get all 4: 4 ℔ Borax will produce. —

Of Inflammable Bodies

The next Class of Bodies to be consider-
-ed is the Inflammable: But before I
describe these particularly, I shall make
a few general Remarks by w^ch we may
always distinguish Inflamation from
Ignition. Inflammable Bodies are distin-
-guished by a quick Succession of their
parts when exposed to burning Fuel: -
-by the luminous vapour or Flame w^ch
they receive on their Surface, or by the
Agitation of all these Appearances in
vacuo. Ignition is said to be when
Bodies in Contact w^th burning Fuel re-
-ceive a great Degree of Heat without

Of Inflammable Bodies

any imediate or sensible consumption of their parts, and when these Effects are readily produced in vacuo.

There are certain Bodies in nature which appear to be luminous without producing or propagating Heat, & which likewise for no consumption of parts. These are called Phosphori.

Tho we find such innumerable Bodies in nature y: are capable of Inflammation yet their Inflammability seems to depend upon the presence of one of these Forms viz: Oils. Sulphur & Alcohol. I not pretend to assirm that these are y: Only

Of Inflammable Bodies

Species of Inflammables, but that they are most Obvious & universal. Chemists in general do not suppose that these several Forms each possess a distinct Inflammable principle; but that they are only different Modifications of one primitive Phlogiston. —

We shall now proceed to consider these Matters in Order, & first the Oily. These are divided into Expressed, Empyreumatic & Essential.

Expressed Oils

These are formed by nature & deposited in Animal & Vegitable Bodies, the most obviously, and frequently in y^e^ former. — They are free from any peculiar Odour or Taste, which distinguish them sufficiently from the ~~former~~ Essential. — Many disputes have arisen whether these Oils are produced by y^e^ Oeconomy of ~~Vegitables~~ Animal Bodies, or whether they are taken in pure w^h^ Vegitable Aliment, and only secreted by proper Organs. — In stead of a living Animal the Expressed Oils

Expressed Oils

are mostly fluid; but in the ordinary Temperature of the Air they either concrete or become ~~flu~~ viscid.

Animal Oils are contained in a tender cellular membrane. Therefore to obtain them we must first destroy this cellular Texture, then liquify and express them. in the Liquefaction of expressed Oils the Heat applied must be extremely moderate, and gradual; Otherwise they soon become empyreumatic & incapable of firm Concretion. These Oils when exposed long to the Air change their White for

Expressed Oils

a brown greenish or black Colour - a-
= quire a disagreable Odour & acrid Taste,
and are then said to be Rancescent.
Rancescency seems to be the Effect of Fer-
= mentation, and this Fermentation seems
to depend more upon y^e^ mucilaginous
matter always more or less present in Oils,
than upon the Oils themselves. for Butter
or w^ch^ of all Animal Oils is the most disposed
to Rancescency, may be kept sweet for
a longer or shorter time, according to the
proportion of the mucilaginous or other
parts of the milk remaining. Hou
Reaumeur found y^t^ by frequent Liquefac-
= tion and

Expressed Oils

Ablutions by procured Butter of a very pure & lasting kind. — Expressed Oils of Animals unite w: fixed Alkalies producing Soaps w: the latter. They unite also w: Earths neutrals, producing Neutral Soaps. They unite w: other Oils, tho' whether by proper mixture or Solution we do not know. —

They unite w: Sulphur forming Balsam of Sulphur. — They dissolve several Metals. The Calx of Lead united w: Expressed Oils forms Common Plaister. They refuse all Union w: Earths and water, excluding the Calcarious w: is properly a saline Body.

They no not afford an Alkali in Calcination like other parts of Animals.

Expressed Oils

In Distillation they give over first watery impregnated w: Acid and then Oils w: ch vary somewhat in the different stages of the Distillation. The Oils thus obtained have been called

Empyreumatic

From a peculiar fœtid Odour ev: they ch retain. They are also of a dark Colour, acrid to the Taste, and soluble in Ardent Spirits. by repeated Distillations their Fetor & Acrimony are diminished, and their Solubility in Ardent Spirits encreased. They may by this means be rendered quite colourless and void of fœtid Odour. in this

Expressed Oils

State Authors have ascribed many virtues to them. but the Labour of procuring them perfect, and the pains necessary to exclude entirely the external Air, which w^ch^ quickly bring on Rancescency render them scarce exhibitive Medicine. if we are careful in conducting the Operation w^th^ a very gentle Heat, and in separating the Faces of each Distillation, three or four Rectifications will be sufficient, Tho D^r^ Hoffman ad: vises ten or twelve. Quick lime must be added to absorb the watery in Oils. —

Expressed Veg: Oils

These are prepared & reposited by nature chiefly in the Fruits & Seeds of Vegitables. like the Animal they are enclosed in cellular Substance, & are to be extricated by the same means. But as they are generally fluid, we may omit Liquefaction. because they are very much disposed to Rancescency & this Disposition is greatly encreased by Heat. When obtained from the most acrid vegitables they are perfectly inodorous. Their Chemical properties & Relation to other Bodies is precisely the same as the Animal. they also afford by Distillation —

Empyreumatic Oils

Which undergo precisely the same Changes as the Animal. The London College directs y: we should distill Oyls which have been immersed red hot in ag: Empyr: Oils. The Oyls serve the same Purposes as Calcarious Earth or Quicklime.

Of Essential Oils.

Essential Oils are obtained chiefly from vegitable, tho' Castor & Musk which are Animal Substances contain an Essential Oil. They generally retain the Odour, and Medical Virtues of the Subjects from which they are obtained, which distinguishes them from the Inspissated & Expressed. From the latter they may also be known by their Solubility in Ardent Spirits. -

They may be obtained either by Distillation w: water, or in some vegitables by Expression alone. -

all vegitables contain more or less of Essential Oils, and this also predominates

Of Essential Oils

in particular parts of vegitables, as the Root, Bark, Body, Leaves, Flowers, Fruit Seeds, and at certain periods of vegitation each of these parts contain the greatest proportion of Oil which Nature intends to bestow thereon. For when Plants begin to vegitate, the Sap precipitated in winter to the Roots rises gradatim to the Trunk, Branches & Leaves &c. Therefore whatever part of any vegitable we employ for Obtaining Essential Oils, let it collected at the point of full maturity. The Nature of the Subject when chosen must be

Essential Oils

entirely & minutely broken down by Trituration, or otherwise according to the size of the parts. and in Distillation on the following Analasis of Vegitables generally takes place.

1st: a Phlegm rises.

2nd: an Acid —

3rd: the Remainder rises in form of a pure Oil which burns darker & darker in proportion to the Duration of the Procep. a Char remains in the Retort which in Calcination yeilds Earth & fixt Alkali. in this procep large Refrigeratories must be employed and the Subject macerated before Distillation

Essential Oils

fill the water hath penetrated thro it.

If we suffer the subject matter to lie at the Bottom of our Vessels they will burn as it is called. Therefore we must use Agitation till it boils. The motion then excited will be sufficient to suspend the matter.

Water is added as a Medium for Regulating the Heat. But it is soon covered with Oil which excludes Air from its surface, and by that means renders it so fixt as to bear a Degree of Heat in which some Oils will be rendered Empyreumatic.

The Oils when obtained must be kept in close Vessels, for in the Air they suffer

Of Essential Oils

a Dissipation, and thereby loose their Fluidity and Odour.

Dr. Boerhaave supposed y^t: all the active power of Vegitables depended upon a subtile matter in their Essential Oils which he called Spiritus Rector: because 3i of Cinnamon in Distillation, after yielding 3ij of Oil becomes a Caput mortuum. This Oil may also be rendered inert by dissipating a few Grains of its weight. The Hypothesis however Specious it appears seems to be groundless, since all y^e properties of the Subject may be restored by a second

Of Essential Oils

Distillation w:th pure Water alone.

Essential Oils unite w:th Acids generating Heat, and w:th the Nitrous they frequently break out in actual Flame. Mr Geoffroy found that a Combination of ye Vitriol: and Nitrous Acids would inflame all the Essential, & Empyreumatic Oils, and most of the Expressed. Mr: Ruelle has since produced the same Effects with the Nitrous Alone, under a particular management. they unite w:th Alkalies forming Soaps. they unite w:th all other Inflammables, — w:th Sulphur forming Bals: of Sulphur: — w:th Alchohol generating Cold. —

Of Essential Oils

They dissolve Lead and its Calx, & act weakly on Iron, and Copper. they refuse all union with Earths. Their Union w: Water is very perfect as we may Ob-serve in the distilled waters of mint. Ro-ses &c w:ch are nothing but Common water impregnated w:th Essential Oils.

Of Camphire.

This is a Substance of a very peculiar nature; but several Circumstances determine us to refer it to the Head of Essential Oils. Like them it is found in the cellular Substance of a particular Vegitable, and may be extracted by the same means. it forms fair white Concretions. Some Essential Oils forming like Concretions have been called by the Chemists Camphires. But the Difference between them is very remarkable. these Oils generate very violent Effervescence Heat, & sometimes Inflammation

# of Camphire

with Acids. Whereas Camphire generates less Heat, & Effervescence & never inflames the w: Acids. Essential Oils do suffer Decomposition in the Fire: Camphire dissolves without Decomposition. Essential Oils are destroyed irrecoverably by Acids: Camphire dissolved in Acids may be precipitated entire by the addition of water. if Nitrous Acid be added in a dilute State to Camphire, it dissolves it only to an Oils & swims on its Surface. —

Balsams & Resins

Essential Oils exposed for some time to the air assume the name & appearance of Balsams or Resins. These contain more oil than Oils to which perhaps their thick Consistence is owing. Their solubility in Alchohol renders them very useful for the various purposes of varnishing.

Fossile Oil

There is properly but One Species of this called naphtha. When it is pure it is limpid and thin, laying aside both the Impurities this in proportion to its Impurity: it is generally found flowing from the Bowels of the Surface of Springs. Asphaltum, Bitumen Judaicum, Pit-Coal &c all afford naphtha in Distillation: Therefore Naphtha & Sulphur must be the Bases of y^e Inflammability of all fossile Substances. to strengthen this Hypothesis, Let us observe that from

Fossile Oil

the Tops of many Mountains, as those of Modena in Italy a naptha continually flows. this gradually in its Descent turns thicker, and more heterogeneous; forming in its passage Petroleum, Asphaltum Bitumen Judaicum, and at last Common Pit Coal. —

Amber & Ambergrease

Tho they appear different from Fossile Oil: yet in Distillation they give a perfect naptha & Vitriolic Acid. Ambergrease is distinguished by a very fragrant Odour. — Amber resists the Force of Saline Menstruums

Amber

But in Distillations yeilds 1:st water 2:d water and Acid 3:d Dry Salt. 4:th a Fosile Oil. the Residuum dissolved in rectified Oils becomes a fine Varnish. —

Of Soaps.

The Term Soap has been applied to all Combinations of Oil w:th Saline matters. The Combination of neutrals Oils is only temporary, a Seperation very soon succeding their Union. The term is only proper for Combinations of Alkali & Oils. Soaps may be composed of all y:e different Oils; yet the Depured are most commonly used. Some have preferred the use of Fosfile

Soaps

Alkali for making Soaps because y^e^ Soaps
brot from the Mediterranean / where y^e^ fossile
Alkali is employed / are better than those
of other Countries. This however seems to
depend upon the fresh veg: Oils w^ch^ the
People of the Countries near y^e^ Mediter^n^
are able to procure. for we find by Expe-
riment that Fossile and veg: Alkalies of
equal purity produce with the same Oils Soaps
nearly similar. The Alkali employed
must be in a Caustic State, & y^e^ London College
direct us to dilute it w^th^ water 'till a
Pint of the Ley weighs only 16½ Z. – This
will do for most Oils, but a much stronger

Of Soaps

Ley will be required for the solution of the oils of Fish, w^ch are generally used for our soft Soaps. The Ley & Oil being combined, we must subject the mass to gentle Heat w^th considerable agitation till a clear gelatinous substance is produced. This mass may be formed into concrete Cakes, by the addition of a neutral Salt to seperate its water. a portion of the Salt always unites w^th the Soap w^ch renders it an improper Medicine in some Cases as in the Arthritic, and hurts its purging Quality. Soap may however be freed from Common Salt by dissolving it

in Alcohol, when the Salt will be precipitated. The Alcohol may be recovered by Distillation, and the Soap remain very pure. — This I must observe is a very tedious practise. The Heat employed in the Ordinary process for making Soap is not hurtful. Mr. Geoffroy among many others was of the contrary opinion. he therefore proposes that we should make Soap by Agitation, and a perfect caustic Alkali, without the application of Heat. but we object to this proposal that the time required for a perfect union of the Oil & Alk. would render the former rancescent, and

Consequently render it useless for the purpo-
-ses of Medicine.

Soap is liable to Decomposition When expo-
-sed to the Air. Therefore when it is to be
used as a Medicine all sh^d. be previously
taken off w^ch: has been corroded by the Air.
for this Reason also a great number of
Soaps sh^d. never be made at a time.

- Does this Decomposition depend upon
the Absorption of an Acid or Mephitic
Air? — Soaps may also be decomposed
by Acids separate or combined w^th: other
matters. the Oil Obtained by y^e Decompo-
-sition is ~~sufficiently probable for~~ w^ch is
~~refer you to [illegible]~~ soluble

Of Soaps

in Ardent Spirits. Maquer's Theory concerning this Subject is sufficiently probable, for which I refer you to his work. The first is also partly converted into a Volatile Alk: so y^r: by the addition of Vitriolic Acid to Soap I get a portion of Vitriolic Ammoniac, w^h: the vitriolated Tartar. as this is very generally a peculiar kind of an Acid present in the Stomach, Soaps when taken as a Medicine commonly in Consequence of a Decomposition. —

Of Sulphur

The second Species of Inflammables is Sulphur a concrete friable mass, not soluble in Acids, water or Alcohol. all M: I: are found in Combination with Sulphur except Gold, Zinc, and perhaps Platina. Arsenic affords it most plentifully, and it is the Opinion of some Naturalists that these two either Seperate or in Conjunction mineralize all the M: I found in a State of Ore. When a small proportion of Sulphur is combined with Arsenic, the Compound is called Orpiment. When a very large Proportion it is called Sandaracha. Sulphur is frequently found native in

the Earth. but the most common way of obtaining it is from Pyrites by Eliqua-tion. it is afterwards purified by Sublima-tion, & collected in a powdery form called Flowers of Sulphur. —

Sulphur may be artificially produced by a Deflagration of Charcoal w.th any neutral Salt containing Vitriolic Acid, for in Con-sequence of Deflagration a Hepar Sulphuris will be produced from which pure Sulphur may be precipitated by any of the Acids.

Vitriolic Acid and Lead forms a Metallic Salt from which Sulphur may be obtained by ~~Distillation~~ Sublimation. it may also be produced by Distillation w.th

Of Sulphur

Vitriolic Acid & Oils, or entire vegitables which contain Oils. This last Fact explodes the Opinion of some who have not that Opium was the only vegitable matter from which Sulphur could be extracted by this means, and that from most of its Virtues were derived. It may also be obtained by adding Oil to Alcohol. Thus we see that Sulphur may be formed by adding its Acid to either of the other Species of Inflammables. Is not this favourable to the Opinion of one simple & universal Phlogiston?

Sulphur may be decomposed by Fire.

Of Sulphur

The Acid of the Sulphur is also in some measure decompos'd by exposing to the Air. And if united w: Filings of Iron breaks out into actual Flame. it sublimes entire without leaving any Residuum.

Sulphur is not dissolved evenly by the most concentrated Vitriolic Acid. it is soluble in Alkalies forming w: the first Hepar Sulphuris w: Substance is much of y^e^ nature of Soap. It is Soluble in Water & Alcohol. its Solubility in the latter gives Rise to the Tinctures of Sulphur, and we include under this Head w: are called Tinctures of Antimony & other Metallic Substances, for it is certain that the Metallic part of these are no way

affected by Alcohol. - Hepar Sulphuris is a very powerful Menstruum for Mr: it even acts upon Gold so far as to render it soluble in water. The Matter precipitated from Hepar Sulphuris by the Addition of an Acid is called Lac Sulphuris. The Fumes of Hepar Sulphuris turn ℔ White Metals of a black Colour. Letters wrote w: a Solution of Lead or Silver why dry do not stain the Paper; but if applied to the Fumes of Hepar Sulphuris immediately become legible.

℔ Sulphur distilled w: Sal Ammoniac and Quicklime gives a Liquor strongly impregnated w: Sulphur & a vol: Alkali w:ch ℔ss

Of Sulphur

called Tinct: volat: Sulph: Hoffmanni.
Quick silver added to this Tincture forms
Cinnabar. —

Sulphur unites ℞ w: all Oils into Balsams
entirely changing their Properties. it does
not in a perfect State unite ℞ w: Alcohol. —

It has a great affinity to Metals:
so y: Chemists in all Ages have supposed y: a
pure Elementary Sulphur entered into the
Composition of all metal: Substances.

In a Separate State it has no Effect
upon Earthy Bodies, but in the form of
Hepar Sulphuris proves a powerful flux
to them. —

Of Alchohol

Alchohol, Spirit of wine or Ardent Spirits is produced by art from a particular Fermentation of Vegitable Juices only. The term Fermentation was formerly applied to the Production of Alchohol alone, But as later Chemists have enlarged its Signification it will not be improper to Speak of Fermentation in general, and then describe each particular Species.

Of Fermentation.

If in any mass of matter an Intestine motion arises, it is propagated thro the whole till it becomes homogenous

and if a portion of this matter being added to a Quantity of Fresh, the latter is assimilated, and becomes also homogeneous, such Matters are said to be in a State of Fermentation, and y^e^ matter added is called a Ferment. y^e^ Maturation of the Fruit, Seed, &c of vegitables, and the Rancescency of Oils seems to be owing to peculiar Fermentations. The Diseases of Animals and vegitables sometimes depd. upon Fermentation excited by a Ferment. Thus in Inoculation for the small pox, the little portion of Variolous matter added assimilates the whole Fluids of a sound animal Body, & thereby induces y^e^ Disorder

Of Fermentation

Again if an Ear of wheat affected with the Smutt be applied to Grain in y^e most vigorous State, the latter will soon receive the Infection, & communicate it to the next contiguous, so y^t in this way the Fermentation may be propagated ad Infinitum. —

Fermentation is divided into the Vinous w^ch produces Ardent Spirits, the Acetous w^ch produces an Acid — and the Putrefactive by which a vol: Alk: may be obtained. The first of these is w^t belongs to our present purpose, and we shall therefore confine Ourselves chiefly to y^t

Vinous Fermentation

This takes place only in vegetable juices, and more or less in these according to the quantity of Saccharine matter which they contain. When all this matter is extracted from any veg: substance it becomes incapable of Fermentation. From this it appears that the vinous Fermentation cannot take place without the presence of Saccharine Juice. — The ancients thought all vegitables were capable of this Fermentation, but we find that the very acrid bitter or aromatic plants are not only themselves incapable of vin: Ferment^n: but they prove to be powerful Antiseptics

Of Vinous Fermentation

Dr. Boerhaave ~~[illegible]~~ distinguishes the plants incapable of Fermentation into Alcalescent & Acescent.

Among the Vegetables &c. are proper Subjects of Fermentation, some contain in their Juices a Sugar prepared by nature which runs spontaneously into Fermentation. Others require Artificial Means to evolve their Saccharine matter, such as the farinaceous Seeds of Plants. Liquors produced from the former kind are called Wines; those obtained from the latter are called Ales or Malt Liquors.

The Juice of the Vine is a Subject &c.

Of vinous Fermentation.

most commonly, and w: the greatest ~~ad~~ advantage employed for the making wines of any whatsoever. The Saccharine Juice when first expressed is called <u>must</u>. This must be dilu- :ted w: three times its own weight of water, and exposed for some time to the Air in open vessels which must be kept as much at Rest as possible. The matter in this State is turbid, more viscid than water, flat & sweet to the Taste having no peculiar Odour. After it has remained some days air Bubbles begin to appear w:ch being very elastic re- -pel each other quaquaversum. This causes an Intestine Motion attended w: some Heat & Intumescence. These Bubbles arising at

the Surface are there entangled, by the
Viscidity of the Liquor, & at length form a
Crust. from this a Vapour is exhaled
which affects Animals with Giddiness &
Palsy, - extinguishes Flame, and renders
Caustic Alkali mild. during the Process
Earthy Matters are precipitated to y Bottom
— we must then divide the Crust with the
Hand, and if the seperated portions do not
remain perfectly at rest, but discover the
least tendency to unite, we may conclude
that the Fermentation is not sufficiently
perfect. After these Appearances y Liquor
becomes transparent, & void of Viscidity, ac-
-quires a poignant taste & grateful Odour,

Vinous Fermentation

assumes the Title of wine from which Alcohol may be produced by simple Distillation. we must secure it in Bottles, where in Order to its becoming wholsome Drink it must undergo Another slow & long Fermentation. the following Circumstances must be observed for expediting y^e^ Fermentation, first the proper Fluidity of y^e^ Liquor 2^nly^ the proper Application of Heat 3^rd^ the Communication w^h^ y^e^ Atmosphere 4^th^ y^e^ undisturbed State of the Bubels. —

As to the I^st^ Ingredient I shall observe y^t^ Sugar is a Salt w^ch^ in its dry concrete Form is dissoluble in water & Alcohol, very inflammable, and not only incapable of Fermentation,

but is really one of the most powerful Antizeumicks we have. when it is diluted w: $\frac{1}{3}$ of water the mixture is called a Syrup, which also resists Fermentation. on the contrary if the Liquor be too dilute, the air Bubbles arising in Fermentation will not be sufficiently inviscated, and on that account will explode and discharge a matter & Exhalation of which some absolutely necessary for the production of wine. the most general practice is to procure the Liquor of such viscidity as exactly to bear a new laid Egg — perhaps a still greater Dilution will

not be improper: Observing at y^e^ same time that much greater Visidity is required in hot than in cold climates. The best proportion for home made wines is 5 parts of water, and 3 of Sugar & Fruits as Currants &c.

II.^ly^ The lowest Heat at w^ch^ vinous Fermentation takes place is 42°: and if the Heat be encreased to 80°: an Evaporation of the Liquor will be produced. D^r^ Boerhaave imagined that y^e^ best Degree of Heat is between 60° & 70°. But the finest wines seem to be produced in Temperatures between 50°: and 60°. The intense Heat of the torrid Zone is the Reason why no good wines are produced in Countries,

exposed to its influence.

III.ly We may by Digestion produce some small Degree of Fermentation in vacuo. but free access of the Atmosphere is requisite for rendering the Vinous complete. —

IV.ly The heat of the Sun contributes much to the Formation of Wine, for by Agitation the necessary Formation of a Crust on the Surface will be prevented, & the precipitated Lees be raised up which never fails to renew the Fermentation.

All Attempts to establish a Theory of Fermentation have as yet proved

Vinous Fermentation

It is generally thot to depend upon a Resolution and a certain Reunion of the parts of Saccharine matter. These Phanom: may also depend upon the Introduction of some new matter into the subject, or upon y: Dissipation of some peculiar matter from it during the Fermentation. We can determine w: some accuracy y: a Resolution of the Saccharine matter takes place. That the matter first liberated is an Acid appears from the Taste which the Subject matter acquires, and from y: power w: all Bodies that Absorb Acids exert in checking Fermentation. Another

matter separated is an Elastic Mephitis
as appears from its Effects in killing Animals
– extinguishing Flame, & in reducing Caustic
Alkalies to a mild State. we know very little
about the other parts of the Operation.

That the production of Alcohol
depends upon a Reunion, & Reabsorption
of the parts separated, appears very probable
from its total absence when the Mephitic
Air exhales from too great Liquidity or
Agitation of the Liquor, or when the Acid
is by any means involved as soon as it is
extricated. we are hence led to conclude that
the chief properties of Alcohol depend upon

an Acid and Mephitic Air. we may Ob=
serve also that y^e Inflammability of all
Bodies seems principally to the Effect of
an Acid and Mephitic Air, Whence it is not
improbable to suppose that y^e 3 forms
of Inflammables depend upon a simple
Phlogiston formed of these two matters
combined in different proportions, or y:
in Alcohol there is the greatest proporti=
on of Mephitic Air, that in Oils y^e Acid
predominates, & y: in Sulphur it predo=
minates still more. —

As both the first & second Vinous Fer=
mentations are apt to proceed too far, we

must prevent it by the addition of some matter which resist Fermentation.

Of these none is more powerful than Sulphur, so that must may be preserved many months in Casks impregnated with Sulphur without any appearance of Fermentation. & for this purpose it is employed by the wine makers. it is hard to say how the Sulphur acts. we know that during Inflammation it affords an acid and a matter in all probability is Mephitic air. Whether it be Sulphur whatever it be seems to act most powerfully as an Antiseptic since it requires a very large proportion of acid to produce

Vinous Fermentation

Effects which may be produced from a given quantity of Sulphur. Fermentation is frequently checked by the Approach of Thunder-Storms. as this happens sometimes without any considerable Explosion it is not improbable to suppose that it is the Effect of Electrical matter with which the Air at that time is greatly impregnated. if this Theory should be found not true, it will be unfavourable to the Opinion of an Acid residing in Electrical matter.

Acids. Alkaline salts - Absorbent Earths - Neutral Salts - Metals - Alcohol - Animal Mucilages. the most noted of which:

are Whites of Eggs - Oils - Resinous Bodies - Bitter and Aromatic plants - Chips of Woods &c are all Antiseptics and most of them are used as such. Alkalies serve to act by preventing the Evolution of fixt Air, or Absorbing the Acid as it is extricated. Absorbent Earths probably act in the same manner tho they differ as being promoters of the Putrifactive Fermentation. Animal matters act perhaps only by entangling the fermenting particles w^ch: Otherwise would renew the Fermentation. The Italians cover the Surface of their Wines w^th Oil, chiefly

Vinous Fermentation

for excluding air as we employ Corks.
- The Resinous Chips & Shavings seem to act partly by their oily properties, and partly by absorbing the first air & ~~absorbs~~ Acid when evolved.

The three forms of Fermentation discussed each retain a very regular and orderly succession. if therefore we desire to reduce a Subject to any particular form: E.g. the putrefactive, we might greatly expedite the work by adding some Body as Absorbent Earth to prevent y^e^ Vinous & Acetous. —

We have observed y^t^ Wines are not fit for drinking till they have undergone a

a second Fermentation. This sometimes is very suddenly and entirely stopped. - The Liquor then becomes vapid and ropy, inclining to putrefaction. The Causes of this Disease may be 1st: Immaturity of the Fruit employed; 2nd: The presence of some Antiseptic substance. - too languid Fermentation at first, by which the whole of the Must is not properly assimilated, or on the contrary 3rd: by too active a Fermentation which dispipates the parts evolved & prevents their Reunion. or 4th: too great a Degree of Cold, which may precipitate parts kept in solution during the usual Temperature

of the Air. We must remedy this Disease by exciting a new Fermentation which may be effected by the addition of a fresh Ferment such as - by Stirring up the Lees or if these have become inactive by adding the fresh Lees of other wine. or it may be sometimes produced by the Application of Heat.

In the Second Disorder to which wines are liable they become thin & sower. this Cause of this may be a second Fermentation too actively renewed. - the approaching warmth of Summer - transportation on Ship Board - a Continuance in Cellars near the Streets of populous Cities, or any

Vinous Fermentation

other means whereby they are subjected to frequent agitation. - upon this acct. the Spaniards & Portuguese add alcohol to their wines before transportation. —

Qualities of different wines.

The newer the wine is, the greater appearance of Flowering when pressed into a Glass and vice versa. wines are strong or weak in proportion to the quantity of Alcohol - sweet or sharp in proportion to the quantity of Saccharine matter they contain.

Italian wines are made sweet generally by checking the first Fermentation.

- this however disposes them to ferment in the Stomach.

The luscious taste of Tokay wines depends upon the sweetness and perfect maturity of the Grapes from wch they are produced.

Rhenish wines are obtained from acid grapes - hence their sharp taste. - wines are made rough by mixing the Husks of Grapes, or by preping them when unripe.

Those which are called virgin wines are obtained by a gentle expression of very ripe Grapes. wines of a proportionally inferior Quality may be produced by a second or third Expression. —

Botanists agree: 1st there is only One Species of the Grapes; and 2dly 3dly different

Of the Qualities of Wines

Changes under w^h they appear according to the Soil, Culture, Climate - Exposure &c. These Changes however are permanent & considerable that a proper Choice of them for producing diff^t wines is extremely necessary. —

The Proprietors of Vineyards never use the Fruit of a Vine which is more than 15 years old. from y^e Age to 100 it is thot to be in a State of Improvement. The full maturity of the Fruit is thot such a necessary Circumstance for y^e production of delicious wines, that y^e people of Burgundy are restrained by the Law from plucking their Grapes 'till a Magistrate has proclaimed them fully ripe. —

Of the Qualities of Wines

A chalky or gravelly soil on y^e^ Southern side of a hill is extremely favourable to the growth, and perfection of the vine. —

Of Malt Liquors.

These are produced from the Cerealia, or farinaceous seeds more particularly Barley. They differ from wines in being produced from vegitables that require an artificial process for evolving their saccharine matter. —

Of Malting

As the Conversion of Grain into Malt, or in other words the Evolution of its saccharine matter, is only the progress of Germination; let us first consider in w^h^ manner nature

carries on this work. —

Seeds when carefully examined are found to contain two distinct parts, one which produces the Root, and y^e^ other the plume of the Plant. When y^e^ Seed is properly supplied w^th^ moisture y^e^ radical & plumous parts begin to germinate, each tending to opposite extremities of the Seed. in Consequence of this Germination a Quantity of Saccharine matter is evolved. this encreases 'till the parts arrive at their respective ends; but after they have been broke thro' the Husk the production of Saccharine Matter is Expired. these Circumstances must be carefully observed in conducting the Operation. — The Barley

Of Malting

must be macerated in water for a Suf-
-ficient time. we must then expose it
in thin Layers to dry. it must be often
turned over to prevent Putrefaction, and
to expose every part equally to the Air.
when the Grains are sufficiently malted, they
must be dried in Kilns made for y^e purpose.
the Fuel employed ch^y smoke as little as
possible. Quick drying leaves the malt
tender and pulverous, yet Care must be ta-
-ken not to give it an Empyreuma. Tho
-whereas slow Drying in the Air renders
the malt tough, and almost reduces it to its
Original Farinaceous State. when the
Grain becomes very sweet, and y^e Plume

is just ready to issue from the Lobe of the Leaf, we may reckon the Malting perfect. –

The Grain thus prepared is to be broke down in Mills contrived for y^t^ purpose, & then y^e^ saccharine matters to be extracted by Infusion in water. This is called Mash-ing. This would be greatly retarded by the Application of boiling water, but that Heat suddenly applied will coagulate the Malt, so y^t^ we sh^d^ be careful to apply the Heat gently. Thus it must stand till a considerably strong Tincture is extracted called Wort. if this is kept too long it will run into an Acetous Fermentation (in England is called Foxing in Scotland Blinking).

Of Malting

The same malt may be infused several times to extract all its Saccharine matter, and to prevent the Fermentation y^{e} w^{d}: take place if another infusion of water continued too long.

Those several Extractions are to be inspissated by boiling for giving a stronger Liquor. - perhaps boiling serves no other purpose, since the wort obtained by mere cold water affords a Liquor equal in every Respect but Strength, to y^{e} Concentrated wort. I must observe however than in the wort boiling we often see fibrous Filaments floating. if these are the Saccharine parts of the Grain remaining in the wort, & which are

coagulated by the Heat as some imagine, the Boiling certainly contributes much to its Inspissation. When the Liquor is sufficiently boiled, it must be cooled hastily in large shallow Vessels. After this it must be subjected to a vinous Fermentation, which is to be promoted by Yeast or some other Ferment. —

Ales are extremely disposed to acetous Fermentation, that it is always necessary to add some Anticeptic substance. Of the Vegitables Hops are most generally employed for the purpose, not only because they powerfully resist Fermentation, but likewise on y^e Acc^t of y^e agreable

of Malting

bitter taste w^ch may impart to y^e liquor. y^e
less heat employed in extracting y^e bitter of
the Hops the more agreable is the taste of
it, for in the common method of boiling
the Aromatic Bitter of the Vegitable is
changed for one y^t is disagreably styptic
& heavy on the Stomach; the Flavour of
the Hops therefore would be more Accurate-
ly preserved by simple Infusion: but as
this practice would be attended w^th a great
Expence of Hops, it will probably always
be neglected by Frugality.

Ales are subject to all the Diseases in-
cident to Wines, and these are to be remedied by
the same means.

Distillation of Alchohol from Liquids

Alchohol being more volatile than the other parts of Wine & Ale, may be ob-
-tained from them by simple Distillation
for this purpose the Liquor must be em-
-ployed at its most perfect State of Fermen-
-tation. in the Conduct of the Distillation
great Care is necessary to prevent Empy-
-reuma, w^ch the Liquor very readily contracts
either from a peculiar Oil which it contains
or from the Contact of the Lees, or other sub-
-siding matter w^th the Bottom of the Vessel.
These Inconveniences are to be obviated
1^st by Agitating the Liquor till it boils for
the Suspension of the Lees 2^nd by bring-
-ing on the Boiling as soon as possible, and

Distillation of Alchohol

steam by preserving a very equal Degree of Heat. Besides the Empyreuma which may arise from too much Heat applied, the vapour may be driven thro' the Refrigerating tube without being condensed. This by the working is called a blowing of the Still. We cannot here avail ourselves of the common boiling point of water for regulating the Heat, because the Still acting in some measure as a Digestor, encreases the Fixity of the water.

In the first part of the Distillation there comes over — Pure Alchohol very much diluted w^th^ water — and if the mouth is

carried on too long, an Acid & Empyreuma-
-tic Oil arise. - Notwithstanding all possible
precaution the Alchohol obtained by the
first Distillation will be impregnated w. 2d
an Empyreumatic Oil. This may be
-luated by rectified Distillations w. 2d water,
but the Chymists finding many Distilla-
-tions considerably expensive, make use
of Acids or Alkalies for concealing the
Empyreuma. Acids are to be preferred
because they give the Spirit a very agree-
-ble taste. —

The Quantity of Alchohol yielded is some-
-what in proportion to the Quantity of
Saccharine matter contained, and by 2d

Distillation of Alchohol

activity of the first Fermentation, which is generally most perfect when we employ the largest Quantity of Malt. —

The Purity of Alchohol may be discovered by its Burning to Dryness. we may procure it to be still more pure when it does not act sensibly upon Caustic Alkalies. But the most accurate Test of by far is the Specific Gravity w: we must examine After every Distillation, and when it comes out the same for One or two Successively, we may be certain it is in the purest State possible. —

The Alchohol whether Obtained

Distillation of Alchohol

From wine Ale &c is exactly y^e same Liquor. the diffirent Odours & Tastes entirely depending upon y^e Essential Oils of the several Subjects.

The Addition of water in making Punch decomposes in Some measure the Oils of the Spirit, so that we may judge but of their Odour in that State. Spirits are improved by keeping in wooden Casks because the wood Absorbs their Oil.

Propeties of Alchohol

It is the lightest & most volatile fluid known except Ether, and vol: Caustick.

Properties of Alchohol

- It is probably the most inflammable for Ether tho' it takes fire at a greater Distance, on Acc.^t of the Vol: Fumes wch it sends off; yet perhaps its Inflammation does not so soon commence upon the sudden Application of Heat. – it in=flames entire without having any Residuum. it will suffer very numerous Distillations without any Change, but w:^th the Addition of fixt Caustic Alkali it gives up an Acid which unites w:^th the Alk: into a Salt very much resembling Regenerated Tartar.

Alchohol when applied to the

Properties of Alchohol

Vitriolic Acid effervesces generating Heat, and under proper management produces an Ether vitriolic; but more of this hereafter.

With the Nitrous it exhibits more violent Effervescence & Heat than w: the vitriolic Acid, producing likewise a nitrous Ether.

Alchohol admits of some union w: the Muriatic Acid, tho less than w: either of the former. its union w: the Vegitab: Acid is still more imperfect.

Alchohol in its Ordinary Degree of purity does not unite w: mild

Properties of Alchohol

Alkalies, but w^th the Caustic forms a matter which has been much celebrated by the Chemists, tho its medical virtues are not properly determined. The famous Sp^t vol: Aromat: is composed of Alchohol, vol: Alk: & Essential Oil. the various processes described by Authors for Obtaining this Spirit, but they are mostly improper. simple Digestion is probably the best method can be employed. the French Eau de Luce is nothing but this Spirit Obtained by Digestion. it dissolves some of the dilaquescent Salts. —

It does not unite w^th & Expressed

Properties of Alchohol

Oils, except when they are united are
=covered from fixt Alkali. it unites w:
the Other Oils in proportion to their quan.
=ty. Sulphur is not Soluble in Alchohol
except in the Form of Hepar.

Alchohol unites w: none of the Metals
Earths or Earthy Salts. it unites w:
water generating Heat, & diminishing
the Absolute Bulk of the Ingredients
before Mixture, but after a certain
Quantity of water is added the Heat ceas.
=ses to be generated, & the Bulk to be
diminished. it coagulates Animal fluids,
and resists every kind of Fermentation.

Properties of Alchohol

I must here observe that wine converted by Fermentation into vinegar does not afford any Alchohol in Distillation alone, but w: the addition of M: S: as in the case of the Sachar: Saturn: &c we may readily obtain a large proportion. Do the M: S: here evolve an Alchohol w: was before latent in the vinegar? or do they contribute to a new production of Alchohol by restoring y^e^ Mucilaginous w: has been dissipated in y^e^ vinous Fermentation? — Down y: y^e^ former opinion is most probable, since we find that very highly concentrated vinegar

Properties of Alchohol

is capable of Inflammation.

Of Ether

This was known to the Ancient Chemists but never came into great Reputation till About Thirty years ago, When Frobenius Invented an Ether to the Royal Society w.th the Intent for Naming it, giving Directions at y.e same time, That it Shd. not be Named till after his Death.

Before that time however two french Chemists discovered the Method of Making it. We have since had various Methods described; but the most simple

Of Ether

easy and the best method is the follow-
ing. —

The Vitriolic Acid & Alcohol must
be taken as pure as possible, in the
proportion of 2 parts of the latter, to one
of the former. We must then put the
Alcohol into a Retort, and add the
Acid very gradually, stopping up the
Orifice after each addition, & Observing
not to add a second portion 'till the
Heat produced by the first has entirely
subsided, for otherwise we shall ha-
-zard a violent Effervescence & Explosion.
— When the Acid is put in first it often

remains at the Bottom without Effer-
-vescence; in this Case we must re-
Agitation.

When the Mixture is thus made
a Receiver must be luted on as close
as possible. it must then be raised by
Heat quickly to a very gentle Ebullition,
and after y^e^ an equal Degree of Fire must
be preserved. in the Course of this
Distillation various matters come
over. 1^st^ Alcohol alone. 2^nd^ a dulcified
Spirit 3^dly^ Ether. 4^thly^ Volatile Vitriolic
Acid, & lastly a more oily Ether called
Oleum dulce. the Matter left in the
Retort now becomes black & thick.

Of Ether.

If the work is continued longer Bubbles will begin to appear, as soon as these are seen the Distillation must be stopped, or such an Intumescence will immediately ensue, as will force the matter into the Receiver. To seperate the Ether from these several matters, we must first pour on a quantity of water. The Ether & a portion of Acid adhering will rise to the Surface immediately. it must then be poured off by a proper Seperating Cup, and to it we must add a weak solution of Alkali and water which will perfectly seperate the Acid, and leave the pure Ether on the Surface of the water.

Of Ether

If by this means the Ether should not be sufficiently pure, we may rectify just the whole to a second Distillation, when the Ether will rise first with a small quantity of Alkali adhering, we must then stop the work, and add to the matter a portion of clear water which will precipitate the Alkohol. more Ether may be obtained by adding fresh Alkohol to the matter in the Retort. -

Properties of Ether.

a Slip of paper dipped in Ether will take Fire at some Distance from the Flame of a Candle. this is

Properties of Ether

a great proof of its volatility & inflam-
-mability; yet it does not possess y^e latter
property so perfectly as Alchohol. It vo-
-latilizes under the Receiver of an Air
pump, leaving an Acid Residuum --
When extremely pure, a drop will exhale
in falling a few Feet thro the Air. It has
been absurdly supposed that Ether will
burn under water, because when water
is poured upon flaming Ether, it is imme-
-diately buoyed to the Surface without
the Extinction of its Flame.

It unites w^th Acids effervescing and
emitting copious Fumes. It bears a
Relation to Caustic Alkali like Ether Caustic

Properties of Ether

matters. It is by no means such a powerful menstruum for oily matters as some have supposed. it extracts the taste imperfectly, but much less powerfully the smell and colour of aromatics containing Essential Oil. it does not unite with Earths or metals. —

If to a Solution of Gold in Aqua Regia diluted w: water, a quantity of Ether be added, the Gold will be immediately seperated and suspended by y Ether in its pure metallic state. this happens with Essential Oils & Alcohol. I am led to mention another Phenomenon

Properties of Ether

with Respect to Gold, that when fused
lb
together w: various Ether Metals, it al:
:ways rises to the Surface. — on What
principles do these Phænomena depend?
— for a fuller Acc: of Ether see Beaumé
Instruments. —

Alcohol moderately impregnated
lb
w: vitriolic Acid gives the — —

Spiritus Dulcis.

This was formerly obtained by Diges:
tion, but in this way the union is
not perfect. we are therefore directedly
the Lond: Coll: to practise Distillation
lb
w: equal parts of the Ingredients &
by the Edin: Coll: w: only $\frac{1}{8}$ of $\frac{1}{4}$ Acid.

Of Spiritus Dulcis

In the latter the quantity of Acid diminished is not sufficient, in y^e former it superabounds. So that we must add. -tile it w: y^e Addition of an Alkali.

The Ol: Dulc: w^ch arises in y^e Distillation of Ether, forms w: Alchohol w^ch is call'd by Hoffman, Liquor Anodynus Mineralis.

Alchohol unites w: y^e Nitrous Acid, & exhibiting the same Phenomena as y^e Vitriolic, only in a greater Degree & forming an Ether which differ somewhat from y^e foregoing in Odour and Colour. This is to be obtained by Digestion only. for the

Properties of Alcohol

violent Effervescence renders a Distillation impracticable. — at any Rate it is extremely dangerous to use a concentrated Acid. We must therefore dilute it w^th an equal Quantity of water. This must be added to an equal Quantity of Alcohol in the following Manner. first put the Acid into a Phialor Matrass. then cautiously pour on the Alcohol w^ch will float upon the Surface of the Acid. close the Aperture of the Vessel as accurately as possible. The Mixture must be performed slowly, and the Vessel closed w^th the utmost Exactness.

Properties of Alkohol.

Winter is the most proper time for this Practise. But at w.ch ever season it is carried on we must rub it in y.e coldest place, and as perfectly at Rest as we are able. The Liquor at different times must be very gently moved, and this is not to be done till no Bubbles appear upon shaking the mixture. The Ether will be collected on the Surface. —

Alkohol admits of a Combination w.th Muriatic Acid, tho' not perfectly enough to form an Ether. —

Its union w.th Nitric Acid is still less perfect.

Having now finished y.e Three

general forms of Inflammables,
we might reasonably enquire whether
there are any more in nature? - I would
rather say there are such Mean determina-
tions: they are. The Inflammable Matter of
Charcoal seems to be of a peculiar kind.
M: O: also seem to have a peculiar In-
flammable quality, since all of them
except Gold and Silver will burn away
in a sufficient Heat. This may be attribu-
ted to the acid ch: w: they contain, but Lime
into whose Composition no acid enters
is very inflammable. —

Metallic Substances.

There is no part of Chemical Knowledge more deficient than y^t of Metals. all the Traditions we have had from ancient times are fallacious & inaccurate. Those among them who were addicted to the Art, kept their Discoveries & Theoretic views entirely secret. — in later Days few have studied the Doctrine of Metals sufficiently, especially the Chemico-historical part. I shall not then attempt to give you a complete view of the Doctrine of Metals. but only their Relation to Pharmacy & Physic, & a few fundamental Facts y^t may

Metallic Substances

I first [illegible] in introducing the Study. I refer You for a Definition of M. S. to the first part of our Course upon this Subject. M. S. are divided into Metals & Semimetals. The distinguishing Characteristics malleability, peculiar only to the former. The Names of them are

Gold
Silver
Lead.
Tin
Copper
Iron
Quicksilver.

The last of them has been acknowledged a Metal ever since the Russian Experiments have proved it malleable. The

Of Metallic Substances

Semimetals are

Zinc,
Antimony,
Bismuth,
Cobalt,
Nikil.

These are all native substances found constantly in the Bowels of the Earth. but before we explain their particular distinctions, it will be necessary to premise a few Theoretical Remarks concerning the Structure of the Earth. —

Theory of the Earth.

In digging into the Earth we find various Strata which cover it. these Strata seem to be concentric, running

Theory of the Earth

Strictly parallel to, or inclined at a very small angle w: the Earths Surface. Their Breadth is frequently extended in a uniform manner, over a vast Tract of Country. — Their Depth is very inconsiderable w: Respect to their Extent, since we generally find near 100 Strata in descending 200 Fathom below the common Surface. The Matter of the Strata is generally Earthy or Stony, & sometimes inflamable. From the Appearances of these Matters they appear evidently to have been suspended in a fluid Form, & from the Shells, and other marine Productions found in the Bowels of the Earth

extremely remote from the sea it is probable that this Fluid was y^e Ocean. Philosophers have adopted various Theories to acc^t for their Appearances. Some think y^t the Earth emerged at y^e Creation in its present Form. Others think y^t the present form was assumed in Consequence of the Mosaical Flood. all seem to agree however that the Earth was once entirely or partially dissolved in the Ocean, and y^t the solid parts subsiding from y^e Fluid formed the various Strata. during this Subsidence it is probable that considerable Cracks or Fissures frequently happened. the

Theory of the Earth

Appearance of Subterraneous Caverns
seem to favour such a notion; for we mostly
find that the Depressions of one side an-
swer to the Eminences of the other.
Mr: Layman a Swedish writer thinks
that he can perceive w:h he calles Origi-
nal Mountains differing in Structure
from the Strata w:h surround them. He suppo-
ses that these Mountains existed before
the Deluge, and that they were never entire-
ly covered w:h Water. That when y:e Flood
retired the solid parts subsided in different
Strata in the Vallies between them. He
says y:t in burrowing a Stratum we often
find it terminating &c: y:e Original side

as he supposes of a Mountain. That
these Mountains are composed chiefly
of Crystalline Matters confusedly blen-
-ded without any regular Strata, and y^t
that they never contain any Marine
Production. None of these Theories per-
-haps can be universally true, since
there are accidental Causes w^ch must ever
since the Deluge have occasioned con-
-siderable Changes in the Structure of
many parts of the Earth. Such are the
violent Eruptions of Subterraneous fire,
or Water bursting from Caverns, or the
continual Falling of Rain which in

a great length of time may produce considerable Effects. to these we may add Earthquakes, and the continual Action of the Air. tho it may be said that these violent Causes do not often act. Yet it may be demonstrated, that they have happened very universally in different Ages.

The waters exhaled from & precipitated again upon the Earth are replete with various matters, many of w: are deposited during their Filtration thro the Earth. These matters combining w: particular parts of different Strata produce the various Minerals & Metal: &c: in Nature. we generally find them in Vertical Fissures

mentioned before, wch by the Metalurgists are called veins. I do not affirm y Metals are always found in y vertical Fissures, and no when besides, for they are sometimes disposed between the Strata, and most frequently in y Original Mountains. The veins of Metals constantly are lined wth an Earthy Crust called by the Miners Spars or Spar. There is between this Crust, and y Metal a thin Layer of Clay. The Metalliferous matter is not always continued uniformly thro the vein, but is often interrupted by various substances interspersed, according to the Strata thro wch it penetrates.

This strengthens the opinion of a certain
something w^ch^ assists the formation of diff:
ferent fossils, and m: substances.

Metals are found in the Earth
under four Appearances.
1^st^: in a native or virgin State.
2^nd^ Corroded or dissolved by Acids in the
form of powder, & sometimes Crystals.
3^d^: in the form of Calces or Precipitates.
I make this Distinction because I am
uncertain whether they assume y^r^ form
by a precipitation from Acids, or by
actual Calination.
2^d^ & 4^th^: State in w^ch^ they are found is that of
One. This happens in Consequence

Of Metals

of mineralization by Sulphur or Arsenic both, or either combined w^th^ an Earthy or Stony matrix. Chemists & Philosophers particularly Dr. Haller have endeavoured to prove that M. S. were generated from Sulphur and Arsenic, but hitherto in vain. When Metals are found in a virgin State w^ch^ more rarely happens y^n^ any other, they are generally in y^e^ form of Plants. hence the Term Vegitation.

Of Gold

This Metal is very universally found in its pure State adhering to an Earthy Crystalline matrix called Quartz. it is perhaps never absent from Sand, tho

Of Gold

seldom in such abundance as to repay the Labour of extracting it. we are however led to think that Metals under some circumstances have a power of mineralising Gold, since Mr. Cronstadt an accurate Author says that it is united often w: Silver, and also in form of w: y: there is a mine in Hungary where Gold is extremely blended with y: Sulphurious Ore of Cinnabar, and of another in Germany which is blended w: Zinc & Iron. —

Of Silver

It is seldom found in its virgin State. often in a saline corroded by Muriatic Acid, when

Of Silver

it is called Luna Cornea, but never in a Calciforme State. It is in Ore Mineralized by, and united with Sulphur. Most Metals when united w: Sulphur become fiable except Silver which retains Brightness & Ductility. it is frequently disturbed with Copper and mony & Lead, but seldom w: Iron. it is sometimes found Mineralized by Arsenic.

Of Lead

It is never in a virgin State as found in the Earth; seldom or perhaps never in the Saline; sometimes in the Calciforme When it is called Spar

Of Lead

which I have seen a Specimen; and frequently in a State of Ore mineralized by Sulphur, when it is called Galena. it is sometimes dispersed w: Iron & Copper.

Tin

I never found pure. Sometimes it is found corroded into a Crystalline Spar. Often Calciforme & mineralized by Arsenic into a Crystalline & semi-transparent Ore. –

Copper

is seldom in a virgin State; frequently in the Saline, combined w: Vitriol. Acid into blue Vitriol; Sometimes in a Calciforme State, but most frequently in the form of an Ore well known by y: name of

Of Copper

Pyrites, wch: differ according to the mine-=ralizing substances. — These may be re-=duced to three. Copper & Iron, Sulphur & Arsenic. — With the 1st: of these is formed the Copper, wch: the 2nd Sulphurious, wch: the 3d Arsenical Pyrites. The Pyrites are hard, friable and inflammable Bodies. 2ly: external Surface is usually of a regularly cubical, or polygonical shape: inter-=nally their structure is in form of rays diverging from a Centre. The 2nd first Species are of a deep yellow Colour, the Arsenical is white; but as these frequently unite we find Pyrites of intermediate

Of Copper

Degrees of yellow. Naturalist say 2 y: When Pyrites are very hard, & crystalline little Copper can be extracted, and also w: 2 they dilaquate in the air. y 2 Pyrites w: 4 contain the greatest proportion of Copper are those w: 4 have a greenish cast, or such as when exposed to the air become covered w: 4 blue and green Efflorescences. - Yellow Ochre is a mixture of Copper and Earth.

Of Iron.

This Metal has been thot never to appear in a Virgin State: but some French naturalists informs us y: it is to be found in the Saline State combined

Of Iron

It is w: Vitriolic Acid into Green Vitriol. This probably gives Rise to its Calciforme Appearance when it is combined w: a certain Cause into Reddish Ochre. This is a remarkable Attraction between this Metal & the Load Stone w: is itself a peculiar Species of Iron Ore. Many Bodies w: which Iron is united conceal this property while in its natural Condition. but if any Body be calcined w: oily or fatty matters, & then applied to a Magnet, it will readily yield every particle of Iron which it contains. For the easier Calcination it will be proper to reduce the matter to powder.

Of Quick-Silver

It frequently found in a pure fluid state. seldom in the saline, & never in the Calciforme. It is most generally found mineralized by Sulphur into an Ore called native Cinnabar.

Of Bismuth

It sometimes found in its native state, seldom in the saline, & often in the Calciforme. it is also mineralized by Sulphur Arsenic & frequently by Cobalt.

Zinc

It never found pure; frequently in a saline State forming white vitriol. Often in a Calcarious when it is called Lapis Calaminaris. The Colour of this is black

Of Zinc

white or brown. Zinc cannot be united to Sulphur, yet we sometimes find it mineralized by other metals, the most frequent of which is Iron. Thus mineralized it is called Blende Galena.

Antimony

was supposed never to have been found pure; but a Swedish Naturalist has proved that the contrary sometimes happens. It is never in a saline or calcareous form State. It is most frequently found in the State of crude Antimony, mineralized by Sulphur, & sometimes by Arsenic when it forms a Reddish Substance.

Of Arsenic

It is never found in its native state. never in the Saline – in the Calciforme it produces White Arsenic. It is often mineralized by Sulphur. When the latter is present in a small proportion the Ore is called Orpiment: but when there is a great proportion it is called Sandaracha, or red Arsenic. it is combined also w: Copper into Arsenical Pyrites. –

Of Cobalt.

well known to Enamellers on Acc.t of its blue Colour. is never found in a Virgin, or Saline, but frequently in a Calciforme State. – It is mineralized by Arsenic, & Iron, by Sulphur & Arsenic & by Iron & Sulph.r &c

Of Platina

Is a Semimetal lately discovered, which is more ponderous even than Gold, hence being used for the Adulteration of Gold the King of Spain in whose Dominions it was found, has prohibited the Importation of it. Specimens of it therefore are very scarce. Dr. Lewis & Mr. Scheffer have given us very accurate Descriptions and Chemical Histories of this Substance.

Of Nikil.

Has been lately discovered by the Swedes, and is not very generally known. it is said to be mineralized by various Bodies, & sometimes to assume Green and blue Efflorescences which has occasioned its being

Of Nikil

mistaken for Copper.

Of Extracting metals from their Ores.

Metallic Bodies are not only in a State of Ore, but frequently are combined w: an Earthy or Stony Matria. When the Ore only adheres to the Matria we may Separate it by breaking it down w: a Hammer, but when the Ore is more intimately mixed, we must powder and agitate it to a stream of water. in Consequence of this Matria which is generally Specifically lighter than the Ore is washed in a Separate manner to a greater Distance. This proces by the workmen is called washing. from those different States of Union w: their

Of Extracting metals from their Ores.

Matrices, has arisen the Division of Ores into Separable & inseparable.

Ores thus obtained have frequently large proportions of Sulphur or Arsenic, which under certain Degrees of Heat have a power to volatilize several Metals. such Metals are distinguished by y Term Rapacious. to remove in some measure this Inconvenience it is generally exposed to a Heat just sufficient to dissipate the more volatile parts Sulphur & Arsenic, wch process is called Roasting. I shall not here be very minute in describing each process, but refer you to Mr Cramer an Docimastica, & make

Of Extracting Metals from their Ores

a few Remarks that may render the Perusal of that Book more useful to You.

Having partially separated the Metals from their Ore, we must purify them further by the Force of Fire, and proper Additions. These Additions may be reduced to three Heads

1st Such Additions as promote Fusion.

2nd Such as absorb or precipitate the Matters mingled with the Metallic Substances.

3d Such as prevent their Calcination, Vitrification, & Dissipation. 4th we also promote a Reduction of them when calcined.

Of the first kind are all fixt Alcalin Salts which very much promote the Fusion of

Metals, but most powerfully of Earthy or Stony matters. To these we may add Quick-lime, and all the Metallic Salts, which have this power in various degrees. Borax is the strongest Flux, but it is so expensive we can only employ it in small Assays. Fixed Alkalies when fused w: Metals are attended w: great Inconvenience, for it unites w: the Sulphur or Arsenic into Alkali Sulphuris, or Alkali Arsenic. both of which especially the former are powerful Solvents for Metals. Quick-lime produces similar

Of Extracting Metals from their Ores.

Effects. Sandiver, or Fel vitri is often employed for this purpose, and is a very powerful Flux. This is a Salt drained from melted Glass. it is composed of the Fixt Alkali & ½ common Salt present in the Kelp w^ch is employed for making Glass; w^th a small admixture of Glass.

Selenites is a powerful Flux for the Earths & Stones united w^th Metals. Calcarious & Crystalline Earths when exposed to the separately to ½ most intense Heat will not undergo the least Vitrification, but when united they become powerful Fluxes to each other.

Glass promotes the Fusion of Ores, but acts more powerfully when united with Metals, so that the Scoria of one Fusion is employed as a Flux in the next.

The second Class of Additions for precipitating the Bodies united with Metals, is proper to Alkalies & Earth. = line, the Inconveniences of which I have already mentioned. Metals may be used for this purpose also, provided y Metal added attracts the Sulphur or = cerns stronger than the subject Metal. We may always find a Metal proper for the purpose by consulting the Table of Elective Attractions. it will be serviceable to have powd and glass w: the mixture. —

Of Extracting Metals from their Ores.

The third Species of Additions is for preventing Calcination, Dissipation, Vitrification, and for Reducing Metals when calcined. for this purpose we may employ all unctuous & Inflammable matters. The Pit of Charcoal possesses this property in a high Degree. Calcarious Earths produces this Effect.

The Communication of the Air is absolutely necessary for the Calcination of Metals, so that if any Body should be interposed between the Air & surface of the Metal, Calcination would probably be prevented. hence the

Addition of Common Salt, or rather Glass, which readily fuse, & defend the Surface of the Metal from the Air.

The Chymists have invented a Mixture which answers all the purposes of every kind of Addition, this is y^e Black Flux. it is made by a gentle Deflagration of two parts of Tartar, & one of Nitre. in the fusion of Metals w^th this Flux, w^ch only serves to Assays upon the Qu^ty of its Volume, the Fusion must be rendered perfect as soon as possible, & then immediately removed from the Fire to prevent Dissipation. There are several marks by w^ch the perfection of

Of Extracting Metals from their Ores.

the process may be determined. if any particles of the metal remain undissolved in the Scoria, we may conclude y: the Fusion is not perfect, but if between the Scoria and the metal a light Film be observed we may conclude y: the Heat has been too great. -

We have already given general Directions for Extracting Metals from their Ores; let us now mention those which require a particular process. -

Gold as it is generally found in a pure state may be extracted by Elliquation & Amalgation, but when combined w: other Metals, it must be treated in the

of Extracting Metals fm their Ores.

general Method.

Silver When in a virgin State must be managed like gold, but when in an Ore it must be purified by Vitrification, or Cupellation w. Lead. This Metal is not only the most disposed to Calcination & Vitrification of any, but also has a general power of calcining & vitrifying Fossile & metal: Substances except Gold & Silver on which it has no Effects. we may get the Silver more free from a Mixture of the Lead, or other heterogeneous Matter by Cupellation, than Vitrification, because Bodies vitrified by Lead become so very subtile in

Of Extracting Metals from their Ores

Tungsten, as readily to pass thro the most compact bodies.

Quick-Silver being of the most volatile metal must be extracted from its Ore by Distillation w^th^ the addition of Iron to fix its Sulphur.

Zinc in the form of Cadmia Galena or Lapis Calaminaris may be extracted by Sublimation by the addition of powdered Charcoal to prevent Calcination.

Arsenic is most conveniently extracted in a metalline form by the addition of double portions of Alkalid Coal to prevent Fusion. it may also be obtained by Distillation w^th^ the addition of Iron

to fix it to Sulphur. This Method however is very imperfect. —

Of the Fusibility of Metals

M.S. are fused by various Degrees of Heat, which has occasioned this Division into Fusible, & Refractory. The incomparably the most fusable, these in Order Tin, Bismuth, Lead, Zinc Antimony, Gold, Silver, Copper, Nickel, Iron. We have not ascertained y^e exact Fusibility of the rest. it is certain however that Platena cannot be fused in a separate State by the Application of any Heat. the Degree of Heat which

Of the Fusibility of Metals

Metals require for their Fusion is very regular in each, tho' we have not been able to determine exactly as a Thermometer cannot be conveniently employed. it is probable that they all acquire an equal Degree when they become red, so that we shall adopt that as a Standard. Tin Lead Bismuth & Zinc all fuse in the Manared Heat. Antimony upon the Approach of it. Gold & Silver directly after it. Copper Nickel & Iron require a Heat much greater than the red: the last of these becomes dilute & white coloured before Fusion. which has been called the White Heat of Iron.

We shall next mention the Changes produced upon different Metals by the Action of

Of the Fusibility of metals

Fire, except Gold & Silver which remain unchanged for any Span of time, in any Degree of Heat which we have yet experienced. Lead & Tin suffer no Change when fused, but from the moment their Fusion begins, a conconsiderable Calcination & Vitrification take place also. Hence we learn that in Cases where these Metals are required in a metallic State, they ought to be removed as far as possible from the Fire after Fusion. on the contrary, Iron & Copper suffer Calcination & Dissipation in their progress to Fusion. if therefore they be required in a calcined State, the Heat applied must not be sufficient to fuse

them: But if we want them in a metallic state, the Fire must be raised as quick as possible. The Semimetals are still more disposed to Fusion, Calcination &c, - wherefore they require both a sudden Accumulation of Heat, and a sudden Removal after Fusion. Zwith: Silver is calcined most readily at 500°: of Farenh: Thermom:

Having mentioned the Fusion of Metals by Fire, we shall next consider its Effects in Calcination.

Mercury is the most easily calcined of any M: in which State it is called Precipitatum &c. &c. Mr Homberg affirms that calcined Mercury contains 1/100 of pure Gold. Next to

Of the Tractibility of Metals

Mercury, Lead is the most disposed to Calcination, then Bismuth, Antimony & Cast Iron. Tin, tho very easily fusable cannot be calcined, but in an extreme Degree of Heat. in Enumerating y^e Properties of M:l: upon a general Subject, it may be taken for granted y^t the Properties of such as are omitted have not been accurately ascertained by Experiment such is the case both on the Subject of Fusion & Calcination.

The next Effect of Fire upon Metals after Calcination is Vitrification. Gold & Silver cannot be calcined, but when corroded by Aqua Menstruum they

Of the Vitrification of Metals

may be vitrified by Heat. Lead is most easily vitrified. next in Order are Bismuth, Antimony, and Iron. Vitrified Lead infinuates of a penetrating Nature, that is eafily pervades the most compact bodies. This is some measure prevented by the Addition of Sand, or powdered Glass.

Having mentioned the Changes of Metallic Substances from their metalic Form to Calces & Glasses; let us next consider the means by which their Original Texture may be restored. This is called the Reduction of Metals. This is effected by the addition of fatty or unctuous Inflammable

Of the Reduction of Metals.

among the most powerful of which is Charcoal. Chemists suppose that the Calcin:n & vitrif:n of M: are occasioned by the Separation of their Phlogiston, & y:a sufficient Quantity, being imparted to them by the Animal or Vegetable Coal, they again assume a Metallic form: But to obviate this Theory we need only Observe, that Calcarious Earths when mixed will reduce M: as well as Char:-coal or Oily Inflammables. is not the matter Separated fixt Air? —

The following Facts are Observed in the Calcination & Reduction of Metals.

Of the Reduction of Metals

that they acquire an additional weight after Calcination, notwithstanding the parts that are dissipated. if however this Calx be reduced to a Metalline State, it will be found lighter than the Mass originally subjected to Calcination. it is very difficult to account for this Phenomena. some Au^rs for the former lay supposing that a^d Additional weight is communicated by a^d grosser parts of the Fuel, but the Exp^rs succeeds equally well when the M. D. is calcined in the Focus of a Speculum, as in a Culinary Fire. nor can this additional weight be furnished by the Air as some have thought; for the Exp^rs succeed as well in vacuo. —

each other

Of the Relations of metals to ~~each other~~

All M: S: may be intimately united ex-
-cept Silver & Nihil. Iron & Lead. Mercury
& Platina. Cobalt & Nihil. add to these
Exceptions Zinc & Bismuth w: unite w:
each
none. Bismuth & Nihil do not unite
alone, but if Cobalt be added a union
of the three takes place. most M: S: are
very brittle, just as they begin to con-
-crete after Fusion, by breaking therefore
& examining the internal Structure we
may see when the parts of the combined M:
Substance are sufficiently blended. Other-
-wise it is very difficult to determine.

The white M: S: change the Colour of
the others, more than in proportion to

Quantities added. Thus a small portion of Arsenic discharges the yellow Colour of a large Quantity of Copper.

The Combinations of M.S. serve for various purposes of Art. E.g: the Goodness of Specula's depend upon y^e polish they receive, we also know that y^e finest polish can be imprest upon that Substance which is most brittle, and at the same time most dense and of the closest Texture. Such a Substance we must endeavour then to get for a Speculum. But it also will require One least acted upon or corroded by the Air. The Combination of Arsenic & Copper has been employed for this

purpose on acc^t. of its Brittleness &
light Colour; it is however very readily
corroded and tarnished by the Air. y^e French
Chemists say y^t. a Combination of Gold
& Zinc possess the properties required
more perfectly than any yet invented.

Other purposes of Art require y^e most
sonorous Bodies possible as the making
of Bells. as Bodies become sonorous
in proportion to their Density & Elasticity,
we must therefore chuse a Compound w^ch.
will possess these properties most perfectly.
perhaps Ordonnance requires a Matter
of this sort. Every Mixture of Mr.

Of the Relation of Metals &c

diminishes their Malleability. a small Quantity of Tin destroys y^e^ Malleability of a great proportion of Gold. y^e^ Fusibility of M^r^. is very much encreased by Mixture. For Example 2 parts of Tin 3 parts of Lead & 5 of Bismuth when mingled may be fused w^th^ the Heat of boiling water. Hence Anatomists have been extremely anxious to get a M^r^. sufficiently fusible for Injections, & by that means obtain a perfect Model of the human Blood Vessels. But y^e^ before mentioned Compound is unfit for this purpose, because y^e^ boiling Heat which is necessary for its Fusion destroys y^e^ small Ramifications. y^e^ Fusibility

may be sufficiently encreased by ☿ but it renders it also very brittle, so as to be intirely unfit for the purpose intended.

The Combination of ☿ with the 4th w: M: S: is called Amalgation. Gold, Lead, Tin, Bismuth Zinc unite w ☿ at a boiling heat if powdered. The practise of powdering is only required for Gold. The rest may be united by adding them hot to the boiling Mercury. Silver & Mercury may be united if the former is suspended in dilute ☉, and the latter added in a proportion large enō to saturate the acid, & dissolve the Silver. Luna Cornea with ☿ may be formed

Of the Relation of Metals.

by precipitating Silver from Oz w: Oz. when united with Vol: Alkali produces an Ammon: c: w: unites w: Gr & y Silver may be extracted very pure from y Com: bination.

To unite Copper & Mercy we must take the former in the State of Oxyd dissolve it in vinegar — put y Solution into an Iron pan w: Mercury. apply it to the Fire stir the Mixture w: an iron Ladle till they are united, & then pour off the vinegar. This may be done w: Grasp & yields by the addition of Iron w: attracts the Acid more strongly than the Copper. This Compound is Fusable

nearly at the boiling point & by freq: Repetitions of the process, the Copper assumes the Appearance of Gold. to unite Mercury & Antimony we must heat them in Separate Crucibles, then put y: 2a together, & use Triture. The Mercury Obtained from this mixture is very pure & less liable than formerly to be turned into a black powder. Bismuth unites the Mercury, & disposes it also to unite w: Other M.S. — In all Combinations of M.S. the weight of the Compound is greater or less, & often equal to y: Sum of the mixed. so y: the famous Proposi: of Archimides for determining y: Quantity

of Alloy in a metal will not be universal-
-ly true.

The Separation of M.S. from each other may be best known from their Chemical history and Elective Attractions. we shall only mention here the most precious metals.

Gold may be separated from all M.S. by an Amalgation w.: Mercury to which it has a stronger attraction than any other M.S. - Gold may be separated from all M.S. by Antimony. for this has a power of Volatilizing all except Gold. If Ether is added to a Solution of Gold in Aqua Regia the metal will be suspended in a Separate State between the Ether & Menstruum. it may be also

seperated from Silver by Sulphur which unites w.th the latter only. Gold maybe seperated from Silver by Aqua Regia when we would dissolve the Gold, or by Nitrous Acid when we would dissolve the Silver. when we employ y.e latter it will be necessary for a compleat Solution that there shd. be 3 parts of Silver to 1 of Gold. The Scoria of Lead employed for extracting Gold & Silver is called Litharge. Silver may be seperated by Corrosive Sublimate; or by adding a Heap of Lead in Cupellation w.ch vitrifying the Tin also carries it thro the Cupel, & leaves the Silver pure. It is best seperated from

Of the Separation of Metals &c

Copper by Digestion.. Gold & Silver cannot be separated from y^r Menstruum by Caustick Vol: Alkali, but all other M.S. may: nor can they be calcined in Deflagrations w^th Nitre, w^ch calcine all the other M.S. for a Separation of the baser metals. I w^d recommend to y^r Perusal the Directions given in Cramer's excellent Treatise of the Ars Docimastica. As to y^e particular Relations of M.S. to Pharmacy & Medicine I shall leave it to y^e Pharmaceutical Chymistry, & proceed to y^e next Class of Bodies the Earths. But before this I shall subjoin a Table of y^e proportions of the Specific Gravities of Metallic Compounds to y^e Specific Grav: of y^e Bodies by whose Mixture

Table.

1	2	3
☉ + ♄	☉ + ♍	☉ + ♀
☉ + ☽	☉ + ♌	☉ + ♂
☽ + ♄	☽ + ♍	☉ + ♃
☽ + ♀	☽ + ♌	♄ + ♀
☽ + ♃	☽ + ♋	♄ + ♃
♀ + ♃	♀ + ♌	♂ + ♌
♄ + ♀ + ♃	♀ + ♋	♂ + ♍
	♃ + ♍	♂ + ♋
	♄ + ♌	♃ + ♌
	♄ + ♍	♃ + ♋
	♄ + ♋	♌ + ♋
	♍ + ♋	
	☽ + ♃	

Of Earthy Bodies

Earths are distinguished from y^e^ other Classes of Bodies by the following Marks. They are insipid dry solid Substances. not soluble in water, not inflammable, not easily fused in the Fire, & if fused do not concrete in their Original Form, but re= =main vitrified. This Definition comprehends both Earths & Stones.

Earths according to M^r^ Pott are Absorb^t^ Crystalline Argillacious & Gypseous. but for Reasons before given the latter are properly Saline Bodies, & in the place of them I would substitute the Talky. so y^t^ we shall divide them into 4 principal Genera.

Of Earthy Bodies

viz: Absorbent, Argillaceous, Crystal-
=line & Salty.

Mr Cronstadt has enumerated 9 kinds
of Earth 1st Calcarious, 2nd Silicea, 3d Gra-
=natea 4th Argillaria, 5th Micacea 6th Schorl
7th Asbestina & Zeolites, 9th Magnesia. These
are however alterdmible to the Divisions
we have adopted. his Calcaria are a Species
of Absorbent. his Silicea & Granatea are
y Crystalline. they are fusible, but y is
nothing to the M.S. w which they are gene-
=rally combined. we know also y M.S. no-
=ne Crystalline Earths fusable. Gypseous
Bodies comprehend his Alcaria, whose
Fusibility like the Gypseous depends

of Earthy Bodies

upon the mixture of other Earths. it is yet doubtful whether his Zeolites are a peculiar Earth or only a mixture. his Argillaceous are the same as Ours. his Micaea & Asbestina are probably Talky. his Magnesia is not very well known, but it is probably a mixture.

Absorbent Earths

The distinguishing Properties of these are as follows. They effervesce with Acids readily soluble in Acids. they are never hardened to strike fire with Steel. if powdered & mixed w. water they do not acquire viscidity or harden in the Fire. they may be divided into 2 general Species i. the Calcareous.

Of Absorbent Earths

properly so called, or such as by Calcination
= on are convertable into Quick lime.
2nd Magnesia Alba. 3d Earths of Alum
or the Lobble part of Clay, 4th the Earth
Obtained from the Calcination of Animal,
& perhaps Vegitable Substances.

I shall only treat of the first 3 Species,
referring upon for the other Species to the
Authors who have given the best Accts of
them. thus for the Earth of Alum to Mr
Margraaf. for the Magnesia & Animal
Earths to Dr Black's Treatise in 4to of Physical
& Literary Essays. —

Calcarious Earths

This Species of Absorbents are of most importance of any other both in Arts and Medicine. They are found under various Appearances either in Strata or in loose Nodules dispersed among other Matter, or in a Crystalline hard Mass called Spar. in this State they are often mistaken for Concretions of the Crystalline Earths. they may be however commonly distinguished by the following marks. Spar when broken are in Rhomboidal Fragments, & held to the Light the Mass seems to be compound of such Fragm:

Calcarious Earths form Concretions of various Degrees of purity, & Firmness.

Calcarious Earths

such are Common Chalk whose texture is Shivery, and its particles impalpable — the finest marbles - and lastly the roughest Limestone all belong to this Sp.

This Species likewise includes the Stalactite which are very frequently to be met with in Caves incrusting various Substances, & sometimes to the Roots of plants giving occasion to the production of the famous Ortho-colla. in short Petrifactions always produce Calcarious matter, as do the Shells of all Animals, all Coral, Fungi Lapidei &c. may perhaps all kinds of Calcarious Earth are animal productions.

of Calcarious Earths

Calcarious Earths appear also under various forms of Marle. The Shells of Animals when they loose their Texture by long time form w.h is called Testacious Marle. When this Earth is mixed w.th Clay it forms the Marle distinguished by the Term Clayey.

Calcarious Earths are employed either in a Solid State, or dissolved in Acids for various purposes in Medicine & Arts. I shall however Speak chiefly of its use w.th Regard to the latter.

It is generally employed as a Manure for Land, either combined w.th Clay into a Marle or in the form of Testacious

Of Calcarious Earths

Marle, or as obtained by Calcination from Lime Stone or Marble. Chalk has been also employed w: success, but in such places as have the Calcarious Earth in no other form but those of hard Concretes. They have been entirely depriv: ed of its use as a Manure till a practice was introduced of reducing Limestones & or Marbles to a powder by a particular machine, in w: ch they become diffa: sable, and equally fit for manuring w: th the other kinds.

Having examined in w: manner they are employed, let us next consider in w:


HEM
2